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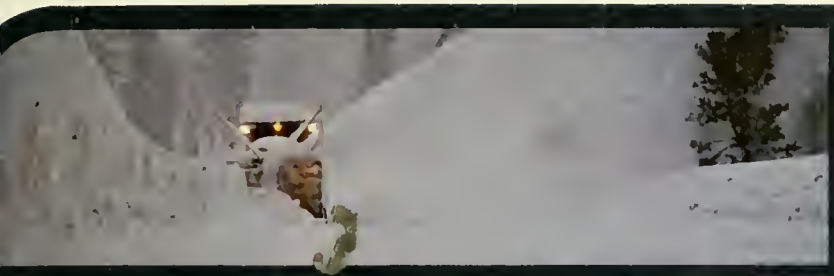

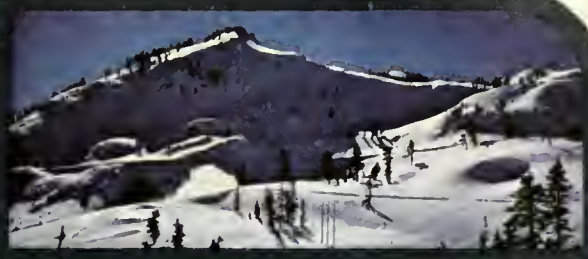

CALIFORNIA highways and public works

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next month

In San Diego during its October 1965 meeting, the Highway Commission adopted a route for extension of State Highway 190 from its present terminus at Quaking Aspen Meadow across the southern Sierra to Haiwee Pass at the Tulare-Inyo county line.

During a photographic reconnaissance of this route last summer, Chief Photographer William Chaney made color and black-and-white photographs of the country the new route passes through. A selection of these photos will be included in the March–April issue.

CALIFORNIA
highways
and public works

OFFICIAL JOURNAL OF THE DIVISION OF HIGHWAYS, DEPARTMENT OF PUBLIC WORKS, STATE OF CALIFORNIA

VOLUME 43 44 JANUARY-FEBRUARY NOS. 1-2

FREEWAY AGREEMENTS 2
By John Erreca

TIOGA PASS—CONSTRUCTION 6

TIOGA PASS—BEAUTY 14

WINTER MAINTENANCE 20
By Marcia Mickelsen

COMBATING SNOW VIA RADIO 30
By Alice Wiegand

SOUTHERN CALIFORNIA STORM DAMAGE 31
By Paul Brown

CAMINO-POLLOCK PINES FREEWAY 32
By Roy Sorum

MARIPOSA ROADSIDE BEAUTIFICATION 34

LIME STABILIZATION 36
By Ernest Zube and Clyde Gates

G. T. McCOY OBITUARY 41

BEAUTIFYING CALIFORNIA 42

HIGHLIGHTS OF CHC ACTIONS 45

NEW LIGHTING FOR PEDESTRIAN OVERCROSSINGS 46
By T. N. Kreiberg

AWARDS AND RETIREMENTS 48

lester s. koritz, *Editor*

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FRONT COVER: Chances are that when this copy of the magazine comes off the press daffodils and flowering trees will be in bloom in the California valleys, but winter will still be hanging over the Sierra Nevada. The front cover stresses the highway maintenance man's view of winter in the mountains. (See article on page 21.)

BACK COVER: Winter comes to southern California mountains, too. Scene on back of magazine is in the San Bernardino Range, on Rim of the World Drive (State Route 18), and not many miles as the crow flies from the City of San Bernardino. Photo by John Meyerpeter.

"An outstanding network of state highways is essential to the future growth of California's economy"
—*Governor Edmund G. Brown*

TECHNOLOGY
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At one time a handshake and now a complex instrument of planning

FREEWAY AGREEMENTS

BY JOHN ERRECA

Formal freeway agreements, signed, sealed and attested, are a must today; no California freeway is complete without one.

But these pacts between the state and cities or counties have not always had their *t*'s crossed and their *i*'s dotted so meticulously.

Back in 1895, when commissioners of the then Bureau of Highways traveled the state in buckboards, a meeting of state and local minds on a road matter was often sealed with just a handshake.

Those forerunners of today's Highway Commission and Division of Highways clippety-clopped about the state, consulting with supervisors and city councilmen about road locations, and setting many of the patterns that are still in use today—including local public hearings at which everybody can blow off steam.

Their surveys and consultations led to recommendations for a state highway network so good that most of its routes are in the system to this day.

Fifteen years were to pass before their roads began to be built, and then there was only $18 million available for about $36 million worth of work. But the cities and counties took up a lot of the slack; counties by providing right-of-way and bridges, and cities by simply taking over the job within their own boundaries.

The habit of cooperation built up over these 70 years, now formalized almost into a ritual, still exists, as the League of California Cities and the County Supervisors Association periodically affirm.

But today the cost of highway projects is counted in the millions instead of the thousands, highway and traffic engineering are more complex, and right-of-way and planning problems more involved, to say nothing of the sudden changes brought about by unforeseen new industrial or commercial enterprises in our vigorous economy.

So today it seems advisable to all parties concerned to have these things down on paper so that there is no question what everybody agreed to during the long period between the time a route is adopted and the time construction begins.

The freeway agreement document—detailed on a map—becomes a reference for any venture, private or public, with plans to build or develop anything on any kind of

property near a future freeway. And sometimes not so near.

In other words, a planning guide. Basically the agreement is that when the state is ready to build, the city or county will cooperate by closing the streets and roads it is necessary to close in order to build the freeway.

Actually it establishes where access to the freeway will be provided by interchanges, which streets or roads will be closed or carried over or under the freeway, the location of frontage roads to carry local traffic to interchange points, and how streets or roads may be relocated or extended to maintain traffic circulation in relation to the freeway.

The authority of the highway people to act as the state's agent is spelled out in the Streets and Highways Code of the California Statutes, which is periodically amended and refined by the Legislature.

The law says that a freeway cannot close off any city street or county road without the agreement of the city or county and that no city street or county road can be connected to a freeway without the agreement of the state.

The law does *not* say that a freeway cannot be built without a freeway agreement, and it would be at least theoretically possible to build one despite the opposition of local government as long as it did not close off local streets.

But the long-established practice of consulting with local people has led the department to adopt a policy that no freeway will be built without the agreement of local government.

The same code of laws also says where highways must begin, where they must end, and sometimes through which points they must pass. Within these limits, however, it does not say around which hill the road must go, or through whose barn, or on which side of the valley.

This is the province of the Highway Commission, which determines the road's course by majority vote after all the evidence is in.

However, in order for the State Highway Engineer to be able to recommend one alignment over another, his representatives will have been working with local planning and engineering staffs and public officials for months or years before a route is adopted or a freeway agreement signed.

Once the commission has adopted the alignment, it is up to the Division of Highways to negotiate the freeway agreement.

Much more often than not, all sides having been kept informed at all stages, no mysteries remain about the terrain features, buildings, schools and other controls that led the commission to adopt the line it did, and the freeway agreement moves in a routine manner through local and state staff procedures to final approval.

A resolution of the city council or county board expresses official approval for the community, and the Director of Public Works signs it for the state.

Delays in signing the agreement are sometimes occasioned by planning or engineering differences that have been at issue from the beginning, with all parties negotiating right down to the wire.

Occasionally they are prompted by a strong local urge to deny that any such lengthy exchange of information took place; to assuage the disappointed with the consolation that their woes came as a complete surprise, sprung by a far-off and rascally state bureaucracy.

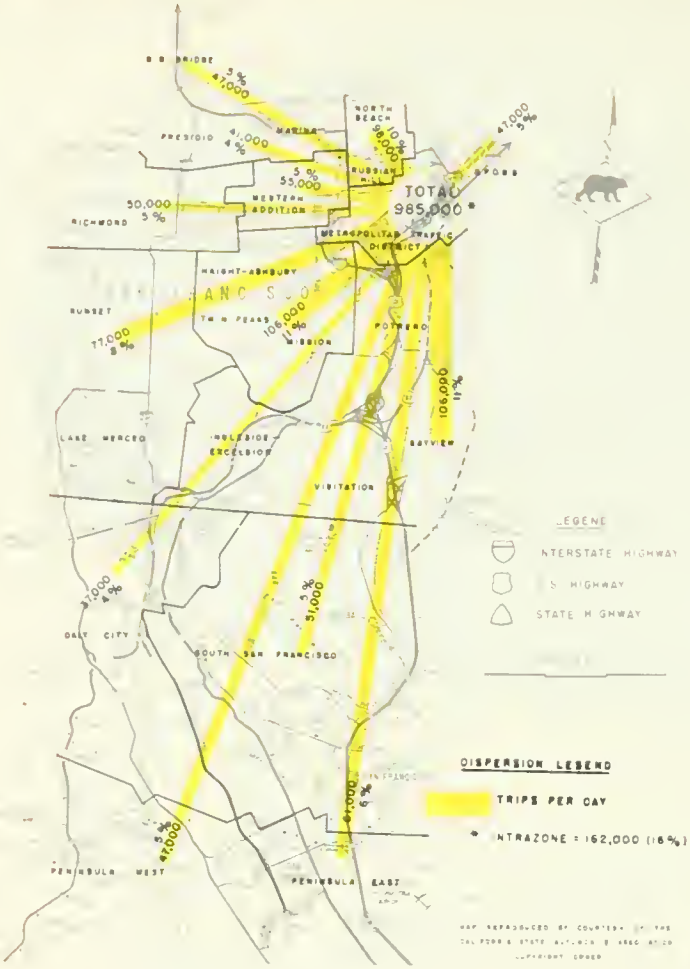
In this "Who struck John?" a standard gambit is to view with alarm any state purchase of right-of-way before the local government has signed the freeway agreement. This makes good copy about who is forcing whose hand.

The fact is that the state will not buy property before the agreement is signed, except under the following two conditions (bearing in mind that the route itself has been adopted, regardless of whether the details have been worked out):

(1) Where some homeowner in a genuine hardship case (a death in the family, orders to Schenectady or Saigon) has to get rid of his house and can't sell it to anybody but the state because nobody else will buy in the freeway's path.

(2) Where a property owner intends to build a facility the state will have to pay handsomely for at some time in the future. (A current case of this kind is one where city and state agree that they will need a certain piece of property for a highway, but where the property owner has a chance to put up and lease a $500,000 building. The formal

Traveling by buckboard, as highway commissioners did in 1895, provided incentive for building good state highways.



Traffic projections show where most cars will want to go. How to get them there is tempered by how not to disrupt a community.

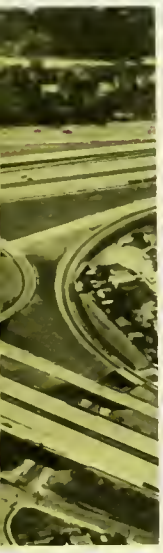
City street closures are clearly defined in freeway agreements as are frontage roads leading to interchanges.

The Highway Commission, seated on dais, considers positions of all interested local citizens before adopting a route line.

freeway agreement is many months off, but if the Division of Highways wants to save the taxpayers the $500,000, it must act soon.)

The long process leading to a freeway agreement begins when state highway engineers apply to local planners for information about local master plans, projected land use patterns, present and future transportation facilities, and projected population figures, and, in turn, explain what they have learned about "traffic desires."

(*Desire line* is traffic engineer shorthand for where the bulk of the people are driving from and where they want to drive to. It is usually shorter and more direct than the way they actually have to go, and, when it is indicated on a map, it is often taken to be that mythical straight-line route engineers are supposed always to build if they can get away with it.



(It is actually a reference line which is almost always modified by the presence of such things as schools, parks, hospitals, office building and so forth that the freeway must go around or over or under. The search is essentially for the route that will disrupt the community the least and be the most economical, while not straying too far from the theoretical line that satisfies the needs and desires of those who drive cars—which these days is practically everybody.)

The state engineers are required to notify and consult a long list of federal, state and local agencies about things like transit, water, redevelopment and public housing, fish and game, parks and conservation. They also work with highway advisory committees, chambers of commerce, businessmen's associations, and civic improvement clubs.

During the preliminaries, a lot of alternate lines will be looked over. As studies progress some of these will be dropped from contention when some practical impossibility shows up (such as a line that would, indeed, miss a corner of the golf course, but would take out the county hospital in order to do it).

No final engineering is completed at this stage, but the same basic engineering yardsticks will be applied to all the surviving alternates for purposes of comparing costs, community effects, traffic service and so on.

The highway district conducting the studies will send its information to headquarters in Sacramento for review and approval. Then the approved studies will be explained to the city or county planning and engineering people and to local officials, and after this to the general public in the traditional public hearing and in informal information meetings.

These will be simple illustrated explanations of what the engineers have learned about the various possible routes, with no opinion expressed about which one they think is superior.

A report on the public hearing, together with statements by local public officials, public correspondence sparked by the hearing, and a complete transcript of the proceedings will be sent to Sacramento where the State Highway Engineer and his staff will study the material and the Highway Engineer will recommend to the commission the alternate he considers best.

The commission then: (a) notifies the city or county that it intends to adopt a freeway route connecting points A and B, (b) sends along the State Highway Engineer's map showing how he proposes to accomplish this connection, and (c) asks if the city or county believes another public hearing would be in the public interest.

Usually the reply is "No," and the commission, if it agrees with the engineer's recommendation, goes ahead and adopts the route. Where the city or county asks for a further hearing before adoption, the commission is required by law to hold one.

When the commission has acted, state people can get down to the business of drafting the specifics of a freeway agreement to propose to the council or board. It may be in fairly broad terms to begin with, because the freeway may not be built for several years. It is always subject to modification by mutual agreement and in fact *is* often modified as new traffic changes take place and construction time approaches.

During this time the close association of local and state people will continue with local planners looking out for the traffic requirements of new firehouses, schools, shopping centers, industrial parks and subdivisions; and state people keeping an eye on all these things plus the protection of the smooth flow of through traffic against too many ramps and interchanges too closely spaced.

The need to have a freeway agreement implies the need to have a city or county plan, and this has acted both as a spur to local planning and as a way to lend state help in this direction.

A professor of city planning, T. J. Kent, of the University of California, has said:

"I also feel quite certain that the constructive hard-driving postwar program of the California State Division of Highways to provide freeways in and around the cities of the state will be seen in retrospect, as one of the major explanations for the establishment of effective local planning programs and the preparation and use of general plans by our city and county governments during the decade of the 1950's."

So what started out as a friendly okay and a handshake over who would oil the road, or feed the hayburners that pulled the scraper, has evolved into an invaluable instrument of city and county as well as of statewide planning.

TIOGA PASS

where roadbuilders meet the rugged west

What has been one of California's most frightening roads, the eastern entrance to Yosemite National Park via Tioga Pass, is undergoing extensive modernization all the way from the park gate down to the valley floor just outside of Lee Vining. At a cost of more than five and a half million dollars, three separate contracts have been let on State Sign Route 120 here to widen and improve this road, particularly along the high, sheer cliffs of Lee Vining Creek Canyon. When all three contracts are completed, possibly in late 1966, the grade and alignment will have been substantially bettered, and the switchbacks which have been so difficult for some drivers will have been eliminated.

Member of Division of Highways survey crew working on rock face when staking for realignment was in progress. U.S. Marines at Pickle Meadows Mountain Warfare training base put highway personnel through course in rock climbing.

On the left, looking up Lee Vining Canyon, with old section of Highway 120 passing diagonally across picture. Around curve at upper center is Lake Ellery. Glacial carving is everywhere apparent in this photo.

The present route through Tioga was a traditional trail for the Indians for thousands of years. Through Yosemite and down several canyons, including Lee Vining, the western slope Miwoks came with acorns, beads, baskets, and other trade goods, to take back things like insect larvae, buffalo robes, salt, and obsidian which they obtained in exchange from the eastern slope Piutes.

From the early 1850's on, prospectors crisscrossed the area, and many claims were located. Copperopolis, in Calaveras County, became the railhead for travel into Yosemite, and the Big Oak Flat road connected to it. Today this is still the continuation of the Tioga Pass State Route 120 when it leaves the park at the western side.

With so many prospectors and other opportunists traveling through, the fame of the scenic valley began to spread, and many visitors came to enjoy the beauty. As early as 1864 Yosemite was made a state park, and in 1890 became a national park.

The growing popularity of Yosemite Valley as a tourist attraction had considerable effect on development of roads on the western side, but mining was the stimulant which brought the road on through the park to the eastern side.

In 1860 the rich "Sheepherder Mine" silver lode was discovered and lost the same year, but was rediscovered in 1874.

By the early 1880's the mining developments of the Tioga Ridge were in full swing, with the Great Sierra Consolidated Silver Mining Company driving a tunnel deep into the mountain in search of an elusive vein. More than 350 claims were located in the vicinity, and Bennettville was established as an official post office. The enthusiastic inhabitants claimed the town would rapidly grow to 50,000 people.

In 1881 there was a telegraph line from the east side through the neighboring development of Lundy, then to Bennettville, and on into the Yosemite Valley. In 1882 the California and Yosemite Short Line Railroad was incorporated in Sacramento to run from Modesto to the Mono Valley either through Lee Vining Canyon or McLean Pass, with its principle destination Bennettville. Although this route was never built, the surveys were completed.

In 1882 the Great Sierra Company, suffering from its

Handling traffic on road while reconstruction was in progress was difficult. Drills had to be moved out of position in cases like this, when traffic passed through.

need for a connection with the railhead at Copperopolis, decided to continue the Big Oak Flat Road to Bennettville. The estimated cost was $17,000, and surveys and construction were started the same year from Crane Flat, at that time the terminus of the Big Oak Flat Road.

Although the season was too late to get much work done that year, construction was resumed in April 1883, and the 56 miles of road were completed in 130 days, being opened for use on September 4, 1883. Cost proved to be $1,100 a mile for a total of more than $61,000, considerably more than the estimate, but a laughable figure compared to modern construction costs. The road was built with a combination of Chinese labor, horse-drawn graders, and black powder. On the section along the shore of Lake Tenaya a hundred "powder monkeys" were working at one time.

In anticlimax, the road never carried a single wagonload of ore, for the mines petered out in the following year, and the Bennettville area was abandoned. Although built as a toll road, traffic dropped off rapidly, and there was not enough revenue to pay collectors. With no funds for maintenance, the roadbed rapidly deteriorated, and by 1890, when Yosemite became a national park, it was little better than a pack train trail. Since the park ranger of that day was a U.S. Army cavalryman, the troopers patroling the park used it for just that.

In the studies by the special state highway commissioners in 1895 and ensuing years, heed was given to the citizens of Mono County and vicinity who were begging for a connection to the more settled areas of the west. A route was recommended which started at Gilroy, in Santa Clara County, and terminated in Mono County with a connection on the then unbuilt north-and-south route which today is US 395, but then was called the "Mono Lake Basin Road." The east side road would connect with the Tioga Mine Road, and continue down the Big Oak Flat Road. Today this is Route 120.

Three alternatives were considered. One was via Mill Creek, a second was through Bloody Canyon, and the Lee Vining Canyon route was the third possibility. The Mill Creek Route turned west from the north-south route above Mono Lake about at the foot of today's Conway Grade, and approximately where Pole Line Road now heads east. It climbed past Lundy Lake and presumably crossed the ridge at Dore Pass or Lundy Pass, then connected to the Tioga Mine Road at the site of the abandoned town of Bennettville.

The Bloody Canyon route is about three miles south of Lee Vining, the next canyon below the present 120 route. Here the road would climb Bloody Canyon, past Walker Lake and over Mono Pass, then down Parker Pass Creek to join the Tioga Mine Road in Dana Meadows.

These five criteria were weighed: (1) elevation, (2) slope stability and possibility of slides, (3) length of useful season, (4) cost, and (5) service. Tioga Pass was the lowest, but all were close to 10,000 feet, plus or minus a few hundred.

Lee Vining Canyon was chosen because it was first in categories 1, 3, and 4, and a close second in 2. Although it was third in service, this was a relative value, as even today the east side here is only sparsely settled, and much of the traffic is recreational. To be sure he was right in his recommendation, Commissioner Manson, in 1898, actually went over the entire route on foot. Afterward, the commission recommended a total of $30,000 to build the road.

In 1899 a special commission serving the Secretary of War, of which one state highway commissioner was a member, again restudied the three possible routes, and again recommended Lee Vining Canyon. In February of that year, the State Legislature had already appropriated $25,000 for the work.

By 1901 surveys were completed, and in 1902 the first few miles of the lower part of the route were let in contract. Specifications called for a road 12 feet wide with 18-foot turnouts. The contractor failed in his obligations on this job, and in 1905 the state had to complete the work.

In 1903 the Legislature voted another $25,000 for the highway, and a second contract for the higher portion of the job was let. On this job the contractor failed to satisfy the state in carrying out the specifications, and his bonding company took over to complete the work about 1910. Total construction expenditure by the various agencies was more than $75,000, rather than the $30,000 originally estimated.

Although the road remained under the State Engineer until 1917, when the State Highway Commission became more than an advisory body, the route did not get much attention until about 1913, when automobiles were first allowed in the park. Occasionally, well-prepared wagon parties took the trip through and made the loop to Tahoe and back via the Tahoe Wagon Road to the Sacramento Valley, but with the admission of the automobile, the traffic load began to build up. This was increased again when the state engineers laid out the John Muir Trail in 1915.

Lower end of Lee Vining Canyon with Elephant Head in upper center. Photo was made just before blast. Office complex is right center where dust is seen.

Same view as on left, about a minute after blast. Dust has cleared sufficiently so notch blasted for new right-of-way can be seen.

View of old section of Route 120 just after Elephant Head shot. Small amount of rock on road from blast directly above shows excellent control of the shot.

By the close of World War I, there was great pressure for a better route into the park—an "all-year highway" up the Merced Canyon directly into the Yosemite Valley Floor. The Yosemite Valley Highway Association put 200,000 certificates on sale at $5 each to raise $1 million which would be matched by $700,000 state and federal money to build the road. The certificates were to be purchased by each of the state's 477,450 registered motorists (in 1919), in return for which each subscriber would receive a season's pass to Yosemite.

In 1926, when Governor Friend William Richardson dedicated this route at its opening, the fund actually had reached the sum of $112,000, but construction to El Portal at the park entrance had cost $1,200,000! Where the old routes had climbed close to 6,000 feet, suffering serious snow difficulties in winter, the new "water-level" route stayed below 3,000 feet, with snowfall negligible. The commission hoped to have enough money to pave the new road the following year.

The National Park Service in the meantime had taken over the old Tioga Mine Road, and it still was the main thoroughfare through the park. Some improvements were made, but funds were short, and the old route continued to serve, although it unnerved many of the drivers of the 20's, 30's, and 40's who, with the improvements in road design, had become somewhat less adventurous than those of the first decade.

In the late 1930's, with minimum funds, the state made some improvements on the eastern end of the route, and repaired the Big Oak Flat Road, which it had taken over in 1915. The Wawona Road was also in the state system by now, so that the park had three routes feeding into it from the west, with only a single substandard route to carry traffic through the park. Actually, only a small percentage of the traffic goes beyond the valley floor, but it was not unusual, when drivers unaccustomed to mountain roads continued through, for them to freeze at the wheel on the descent from the pass, causing considerable delay on the narrow right-of-way.

In recent years the National Park Service, with Mission 66 funds, has realigned and modernized the old road in the park, bypassing much of the Tioga Mine Road route. The current state jobs on the eastern section will now make it possible to travel all the way through the park on a modern highway.

After leaving US 395, on the first six miles of the climb to the pass, the road ascends from 7,400 feet on the valley floor to 9,600 feet at Lake Ellery. At a few places the grade goes to 7 percent and once or twice to 8 percent, but, generally speaking, the new alignment produced by the design team gives an overall grade of slightly under 6 percent. However, Tioga Pass will always be a high mountain route, and probably never will be kept open in winter.

Of the three contracts which will bring this eastern portion up to modern standards, the first and completed one was perhaps the most difficult because of its height and the great amount of rock work required. This job, started in 1963, could not be completed until late autumn last year, and, due to early storms, it was for a while touch and go whether it would be completed then.

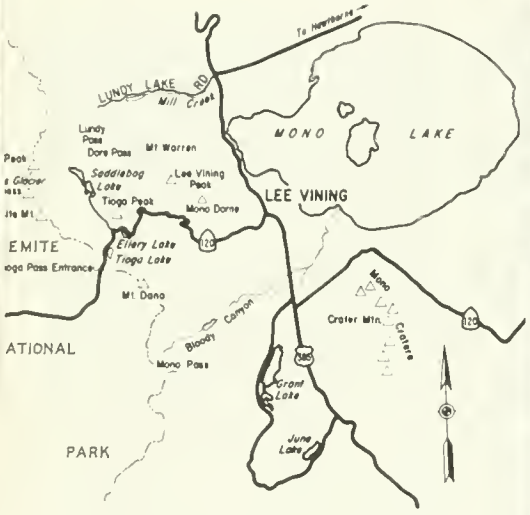
Above Lake Ellery a three-mile section which continues to the park gate rises only an additional 341 feet, and here a second contract has been let for widening and realignment. This project includes a cooperatively financed agreement for also widening the entrance to the park.

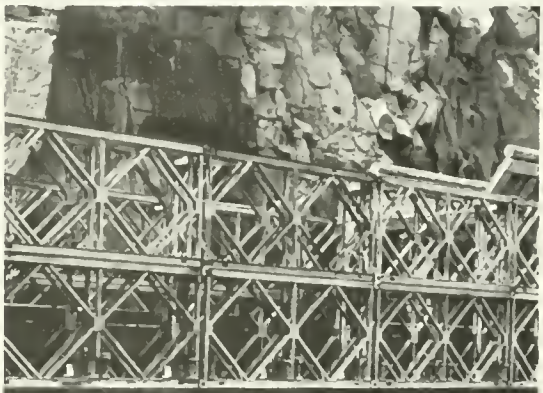
The terrain here is fairly level and little blasting was necessary. However, much of the construction is over glacial moraine, with some of the soil being fine powder created by rocks being ground against each other. Since there is a great amount of subsurface water, even at the end of the dry season, compaction of the fill is difficult. Also, the Forest Service has set strict requirements on preservation of the wildlife habitat. In places Division of Highway employees removed trout by hand from disturbed pools and placed them farther downstream.

Work has been going forward this summer for four miles of grading and paving on a third contract, also let in 1965, costing nearly $4 million, much the largest of the three. This lower job is costing about a million dollars a mile because it leaves the old road and continues on completely new alignment along the steep canyon wall until it reaches the old grade about three miles from Lee Vining.

The main deterrent to a satisfactory grade in the past has been the big rock face near the valley entrance called "Elephant Head." In previous projects design engineers have avoided this face, and kept the road on the valley floor until it was beyond Elephant Head. This has compressed the climb into too small an area for a satisfactory alignment and grade.

The present design calls for bringing the road around the rock face by cutting a small notch to carry the roadway.





Upper left: When blasting was necessary near contractors' and resident engineers' office complex, contractor placed big dump trucks as shields for office trailers. Above: Photo made in 1964 on middle Tioga Pass job shows baled hay used on old sidehill viaduct to protect it from rocks thrown in blast.

Men working in shadow of bridge are doing preliminary work on supports for new sidehill viaduct. Bailey bridge carried traffic for months during reconstruction.

Traffic moving along Tioga Pass road, Route 120, before improvements. In background is "Blue Slide" area which posed special problems of stabilization.

By October 1965 the work had progressed far enough to proceed with the blasting of Elephant Head. The contractor estimated it would require 13 tons of 40 percent gelatin dynamite to do the job correctly, about a pound to the yard of rock. The quality of the explosive was important, as it was desired to shatter this rock as much as possible, to make it suitable for road base.

Since the face of the cliff was so sheer, transport of this much material was difficult. A helicopter was brought in, and it made shuttle trips, with a 750-pound payload each time. The dynamite was carried in a sling. The chopper never landed. Each trip it hovered until the crew on the ground loaded it, and then hovered over the gang on the rock face for unloading, making in all about 30 trips with the explosive.

A seven-by-seven pattern was used in drilling the holes for the shot—that is—the roles were on the corners of continuous and contiguous squares seven feet on a side. Depth of the holes in places was almost 100 feet.

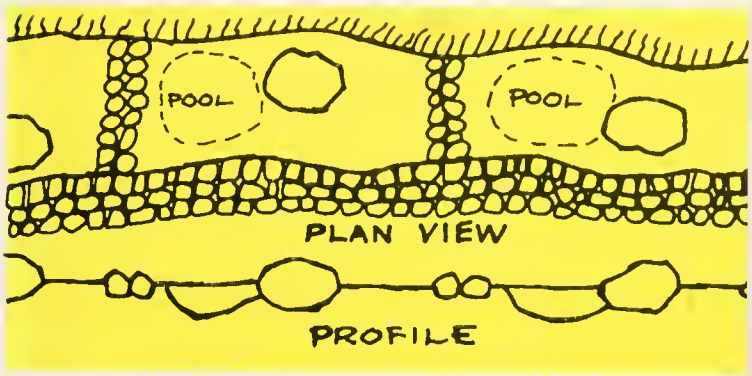
The drilling and the placement of the charges required considerable care and skill, for the old road, which was still carrying traffic, lay directly below the shot area, and a poor shot would cover it with thousands of tons of debris which would take days to clear. On the other hand, one or more additional shots to "baby up" on the cut would be expensive. The shot was designed to throw the 29,000 yards of material to either side, not only keeping it off the roadway below, but breaking it up and dumping it in one tremendous shove, to put it in position as fill for the grade which was coming through.

The blast was fired at 10:50 on October 15, and it was unqualifiedly successful. Not only did the material go where it was intended it should, but the debris which spilled over on the road below was so insignificant that traffic was coming through again in less than two hours. The first vehicle through was a utilities repair truck with crew to repair powerlines damaged by the blast; a casualty that could not be avoided.

Of course, at this altitude, the working days each year on these contracts has been limited. Because of deep snow, the equipment cannot get into the upper project until mid-May or even June, while it might be necessary to move out as early as October. On the middle canyon job, work was suspended the first year on November 20, but the second year the contractor was able to work as late as December 20. This job was completed on October 26, 1965, after three seasons' work, although the original contract called for only 160 working days. It had presented many problems.

The towering walls of the canyon extend upward several thousand feet above the right-of-way, and the sun shines on some parts of the road only a few hours daily. In the shade at 9,000 feet it is often cold on the warmest day elsewhere, and equipment operators working in these areas were bundled up as though working on a winter job, while men in the sun on the same job were working in shirt-sleeves. Because they were often operating really large pieces of equipment on narrow ledges, and the slightest miscalculation meant a fall of hundreds of feet, all three jobs have, in the words of John Sexton, supervising project engineer, produced the "world's finest operators."

The extreme temperature ranges, and the cool days, of course make working with portland cement and asphalt especially difficult. In early September 1965, six inches of snow fell, and there was also snow in mid-October 1965, as the contractor was trying to get the last of the asphalt paving laid.



Sketch shows elevation and plan view of required construction of artificial riffles, pools, and resting areas for trout where channel changes were necessary in realignment of road near summit.

Since the total amount of asphalt paving was insufficient to justify bringing in a hot-mix plant, the asphalt concrete was mixed by the windrow method. The difficulties in maintaining the necessary 60° in the mixture at times seemed almost insurmountable. A traveling pugmill fitted with a fuel oil tank and flame jets to keep the metal surfaces warm was special equipment designed by the contractor in dealing with this problem.

The footings of the slidehill viaduct presented a unique problem, since they had to be constructed on the face of a precipice. A "donicker" which had been planned on as a base for the footing proved insecure, and had to be discarded, but below the bridge there was a slight incurving of the rock face which gave precarious footing to rope-suspended workers. Two foremen refused the job before the contractor could get a man to take charge of forming and concrete pouring.

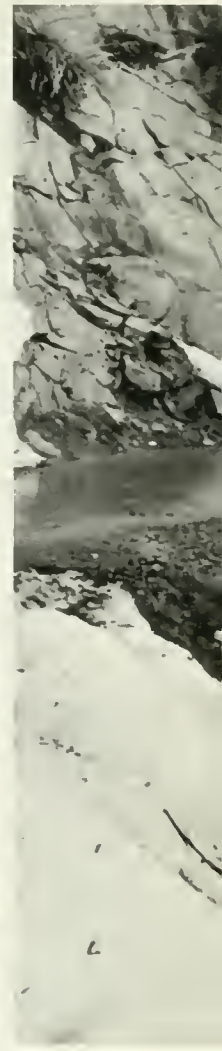
The footings were anchored by steel dowels made from reinforcing rods, and set in the solid rock. A special type 5 class D (seven-sack) portland cement was used, with low alkali and air entraining not to exceed 4–5 percent. As a timesaver, the concrete was mixed down on the flat, and brought to the job in Goodyear Rota bags, holding about 1½ cubic yards. This method, developed for concrete work at radar stations on high peaks, proved very satisfactory. Tremie tubes were used to deliver the material, about 205 yards altogether, to the footing forms.

At that stage in the job when it became necessary to remove the old viaduct, the contract called for building a one-way detour bridge, but the contractor asked permission to use a Bailey Bridge instead, and a change order was issued. The Bailey, a "double triple," was set in place across the gap, above the old structure, and remained there a year, carrying contractor's heavy equipment as well as routine traffic. Of considerable help in handling the Bailey bridge sections were the existing bin walls at either end of the abutments.

Although the road is not heavily traveled, it does carry a steady flow of traffic, mostly vacationers and tourists, during the summer months. In July 1965 this totaled 30,000 vehicles. The summer season, of course, is also the only opportunity a contractor has to work on the road. Construction of a detour was out of the question, and, although the contractor was working on and directly adjacent to the right-of-way, usually 60 or more hours a week, traffic had to be allowed to pass through somehow.

The problem was greatly complicated by the large amount of hard rock blasting necessary, plus the fact the broken material had to be removed to disposal areas. Traffic

Widened route near Dodge Point here awaits final asphalt surfacing. Note snow on windrow of material which must be applied warm.



Bulldozer operator here clearing blast debris from right-of-way in Tioga Pass widening operation bears out resident engineer's comment—"They had to be the best equipment operators in the world."

Aerial view of Route 120, Dodge Point, and sidehill viaduct gives best concept of terrain and problems it presents to roadbuilders. This photo was made before road was improved.

Section of State Route 120, Tioga Pass Road, made in spring 1963, before contractor began work. Curve in center of photo rounds Dodge Point, with sidehill viaduct just beyond. Contract now completed has widened road here, and provided viewpoint.

had to be protected during the shots, of course, but there was also the continual movement through the jobs of a number of oversize rock trucks, as well as debris on the road from the shots.

The district prepared a very effective "handout" sheet, explaining the problem to the traveling public, pointing out the movement of earth and rock involved in the three contracts—1½ million yards—would require a loaded freight train 430 miles long. These problems were met by scheduling the hours the route would be open and closed each day, and these schedules were given the widest circulation in all press media. No mishaps had yet occurred by the close of work this winter, and, since the job in the area most difficult to negotiate—along the cliffs of the upper canyon—is completed, traffic movement in the future will be much simpler in the construction zones.

However, it was not sufficient just to open and close the route. Because of the terrain, the presence of working equipment, the narrow roadbed, and the tendency of travelers to stop for sightseeing, picturetaking, and an occasional vapor lock, there was considerable straggling. While the rule of thumb adopted allowed traffic 45 to 60 minutes to clear, it was found expedient for a Division of Highways vehicle to follow the last car through all three projects, otherwise an occasional straggler might have gotten into serious trouble.

This traffic problem was complicated by the arrival in August 1965 of the Inqua Conference—a group of eminent geologists from all over the world, hosted by the University of California at Berkeley—traveling in buses which could not make the switchbacks. Since the Tioga Pass area and Lee Vining Canyon are of absorbing interest to these men, they had come to study it. By pooling most of the pickups available at the job, assisted by the local national forest officials, all were transported through the job as necessary, and left at the end of the day in a happy mood.

Both the upper job and the lower job at Tioga will continue through at least one more season, before the new alignment is graded and paved. The lower job probably won't be completed until 1967. Some inconvenience to the traveling public will be necessary during this time, but the worst is over.

When all three jobs are completed, the eastern entrance to Yosemite and the Tioga Summit vicinity will be much more easily accessible. For some of the things which will be found up there, see the following pages.

(Contractor on middle job—C. W. McGrath of El Cajon; Division of Highways Resident Engineers Charles Jackson, Lloyd Hopper; contractor on upper job—McGrath also; Resident Engineer E. G. "Lou" Wadsworth; contractor on lower job—Harms Bros., H-B Investment, Inc., & J. W. Briggs Construction, Inc.; Resident Engineer W. R. Coons. During 1965 area supervisor was Associate Highway Engineer John Sexton of District 9.)

TIOGA PASS

its enduring beauty

Disregarding the value of the Tioga Pass route as the only eastern entrance to Yosemite, the Mono Lake-Dana Plateau country outside the park entrance has much to attract the visitor in its own right. The terrain surrounding the summit, in the words of District Ranger Jack Reveal of Lee Vining, "offers even a little old lady a satisfying subalpine experience," which she can easily reach within a few hundred feet of the highway. Since the improvements now underway on the road will make ascent of the pass much easier, it is helpful to look at some of the things in the vicinity which can expand the experience of those using the route.

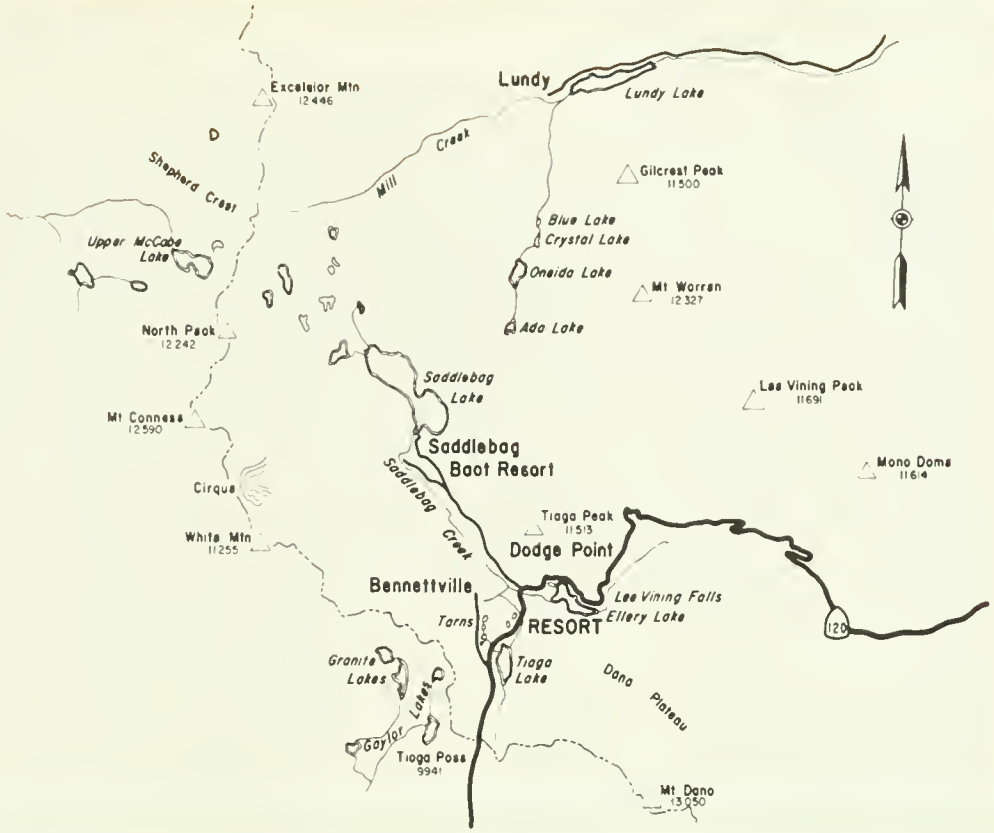
Even before entering the pass there is much to fascinate the traveler on US 395. Not only is this entire section exceedingly scenic, as it passes below one of the most beautiful mountain scarps in the world, but there is everywhere evidence of the great glaciers which carved the present landscape. There is also interesting evidence of volcanic action in the Mono Craters area. The layman can learn to read much of this evidence.

The Sierra Nevada is a single block of granite, with its western edge disappearing under the great Central Valley and its eastern face uptilted and still rising. Its slow rise in response to the great pressures forcing up its eastern edge can be compared to the way a tree root slowly forces up a block of paving in a sidewalk.

This great piece of granite, cracked and faulted here and there, of course, stretches all the way from the southern edge of Lassen Volcanic National Park to Walker Pass in Kern County. As it extends southward, it gradually gets higher, reaching its greatest elevation at 14,495-foot high Mount Whitney, which is also the highest point in the continental United States.

In the several millions years the Sierra Nevada has existed in its present stage, frost has cracked its rocks, and streams have cut deep canyons. During the past half-million years, six glacial epochs have unmistakably marked it for the practiced eye to see. In fact, much of the beauty and grandeur of the scenery can be traced back to the slow grinding of these thick,

A sub-Alpine experience available "even to a little old lady" five minutes from the road



Travelers descending Tioga Pass catch this view of valley beyond through notch of lower Lee Vining Canyon. Odd-looking formations in middle distance are Mono Craters, with White Mountains on horizon.

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heavy ice rivers of ancient times which once flowed down all the east side canyons.

As the ice melted at the end of each glacial age, the water ran into the valleys east of the Sierra and made a chain of great inland lakes. One of these, Lake Russell, was at one time 700 feet above the present surface of Mono Lake, and its ancient shoreline is visible along the slopes north and east of the lake about at the 6,800-foot level. The town of Lee Vining is situated on one of this lake's beaches which was created from glacial debris as both lake and glacier were disappearing. Mono Lake is all that remains of Lake Russell. Its moisture evaporated into the air, but its mineral content was concentrated into the relatively small Mono basin to give today's lake its heavy salinity.

Contrary to public belief and Mark Twain's story about the dog, people sometimes swim in Mono Lake and occasionally use it for water skiing. There are beaches along the shore good for sunbathing, and some of the local people, accustomed to the odd smell and the flies, use them at times. The water does sting, however, when it comes in contact with open cuts or raw places on the skin.

Mono's flies were once a major source of food for the local population when it was the Piute Indians of the "Cutza Dika" group. These east side Piute tribes lived a happy but precarious existence, almost "hand to mouth," and each tribe was classified by the major food source available to it.

In the Mono Lake area it was the larvae of the local fly, called *cuzavi*, which collected in piles in and around the lake and which the local Piutes harvested and dried. Sometimes they ground it into meal. If they had a bumper crop, they traded the surplus to other tribes for necessities.

In other seasons the Mono area Indians lived on greens, rodents and a rare deer when they were lucky; berries, roots, seeds of grasses, and the larvae of the pandora moth which they collected in summer in the Jeffrey pine forests on the higher slopes. In the fall they gathered great quantities of piñon pine nuts from the cones of the singleleaf piñon, *Pinus monophylla*. This was their favorite food, high in nutrient value with good keeping qualities, and they stored as much as they could gather. If the pine nut harvest was poor and a hard winter followed, many Piutes starved before spring.

Seagulls are an important part of the scene in the Mono Lake-Lee Vining area, returning each year in May when the valley has warmed somewhat, and the winter snow has melted. They like Negit, one of the islands in the lake, as a place to nest. The black volcanic rock absorbs the sun's heat and keeps their eggs warm. For the bird lover, the shores of Mono Lake offer haven at one time or another to grebes, mergansers, ducks, swans, teals, bitterns, rails, coots, geese, phaleropes, pelicans, herons, cranes, and other waterfowl.

Just to the south of Mono Lake are the Mono Craters, a series of volcanic cones which geologists say are geologically very young. Studies show that the most recent have risen after Lake Russell evaporated, and are only 6,500 years old. Save for Mount Lassen, this is probably California's most interesting volcanic exhibit. That part of State Route 120 which continues eastward to Benton Station passes close to the craters.

The Mono cones should not be confused with the many small hills and ridges which are seen in the Lee Vining area and, for that matter, all along the eastern scarp of the Sierra. These are glacial moraines, although they are often a mixture of moraine and alluvial fan, resulting from stream action after the glaciers melted. Bloody Canyon, which opens into the Mono Valley just a few miles south of Lee Vining Canyon, has much glacial evidence. This canyon is said to have gained its name because the first pack animals through the canyon in 1852 rubbed themselves raw against the rock cliff faces at the sides of the narrow Indian trails.

The canyon, the creek, the peak, and the town of Lee Vining all take their name from Leroy or "Lee" Vining, the first homesteader in the canyon. In the 1850's he settled near the mouth of the canyon and operated a sawmill for a while, selling his lumber to the many mining camps scattered along the eastern slope and throughout the Mono Lake region. His productivity ended when he accidentally killed himself in an Aurora saloon while handling a pistol he did not know was loaded. Despite popular belief, he did not found the town. It was started in 1923 by a garage owner named Gus Hess, formerly a blacksmith at Mono Mills.

The traveler who turns off on Route 120 just south of Lee Vining and starts the climb toward Tioga Pass will begin to see glacial moraines everywhere. Some are parallel to the sides of the valley; others are like giant steps across the valley—recessional moraines dating back to the end of the last glacial advance, and marking a point where the glacier terminated for a number of seasons before another warm cycle came and it retreated farther up the canyon.

Be sure to stop at the U.S. Forest Service ranger station on the left a few hundred yards outside Lee Vining. Here is easy parking, with nature exhibits and a selection of information sheets on the geology, flora, and fauna of the vicinity.

As the road climbs upward in the pass, it reaches a hard rock area where the right-of-way had to be blasted from solid granite walls. Here evidence of glacial carving and "plucking" is everywhere. On the newly completed section of road there is now an opportunity for study of these features, as well as superb views of the valley, from a new pullout area at Dodge Point, just above the sidehill viaduct.

Dodge Point is said to have gotten its name from an unhappy accident which occurred there in the early days of automo-

Another view of one of Tioga Tarns, with Mount Dana in background. Trees are mostly lodgepole pines.

Tioga Tarns, tiny glacier-made lakes, are like little gems set in rugged surroundings.

bile touring, resulting in the road's only recorded fatality. A pair of young men were traveling the road in a Dodge automobile, and the driver stopped to make a picture of his car perched on the side of the canyon, with his friend at the wheel. When ready to take the photo, he decided the composition would be better with the car in a slightly different place, so he asked his friend to pull it ahead a little. The car was a Dodge of the vintage when those cars still had a gear shift exactly opposite to the standard shift. Unsuspecting, the friend put the gears in reverse instead of ahead, and backed off the cliff, to the horror of his friend, who stood watching, camera in hand.

A mile or so above Dodge Point the road reaches the head of the canyon, and from that point on makes a very gradual ascent to the top of the pass. In this section are continually changing views of Mount Dana, Ellery and Tioga Lakes, and several lesser peaks. Here also, immediately adjacent to the road, are excellent subalpine natural areas.

Both of the lakes, manmade for power development but located in glacier-gouged hollows and surrounded by superb scenery, appear to be natural. About a mile above the Dodge Point overlook there is to be an Ellery Lake viewpoint on the left, and just beyond this the turnoff to Ellery Lake campground. A few hundred yards farther along, on the right, is the turnoff to Saddlebag Lake, about two miles away over a gravel road but normally passable for conventional passenger cars.

High Sierra, Mono Valley, and Mono Lake as seen from ridge at top of Conway Summit on US 395. Lighter line along base of mountains marks old shoreline of Lake Russell. Behind ridge at extreme right center is Division of Highways viewpoint.

Farther along on Route 120, 2½ miles above Dodge Point and just east of Tioga Lake, are the Tioga Tarns—small, glacier-created lakes in a beautiful setting. Since grazing has been prohibited in these portions of the national forest for nearly 50 years, the high country ecology has nearly returned to the natural balance which existed prior to the coming of the white man. In the Tioga Tarns area the U.S. Forest Service has established a nature trail. There are two turnoffs here a short distance apart.

About a half-mile beyond is another connection to the old mining road, and just beyond that, less than a mile from the park entrance, is a left turnoff to the Tioga Lake vista point. This is a total of nine turnouts for recreational purposes in a four-mile stretch, but parking will be permissible at other points where vehicles can get completely clear of the traveled way.

The vista points have been selected in each case to give the best possible view of the scenic area, and the campgrounds are Forest Service administered with the usual facilities of that agency. The old town of Bennettville will be disappointing to all but inveterate history buffs, for nearly all the buildings are gone, and the machinery has been moved down to the Pioneer Museum at Wawona.

The Smithsonian Institution has been trying to get at least one piece—the Burley Air Compressor—but the park rangers are obdurate. It turned out this is the only specimen of this type compressor left in the world.

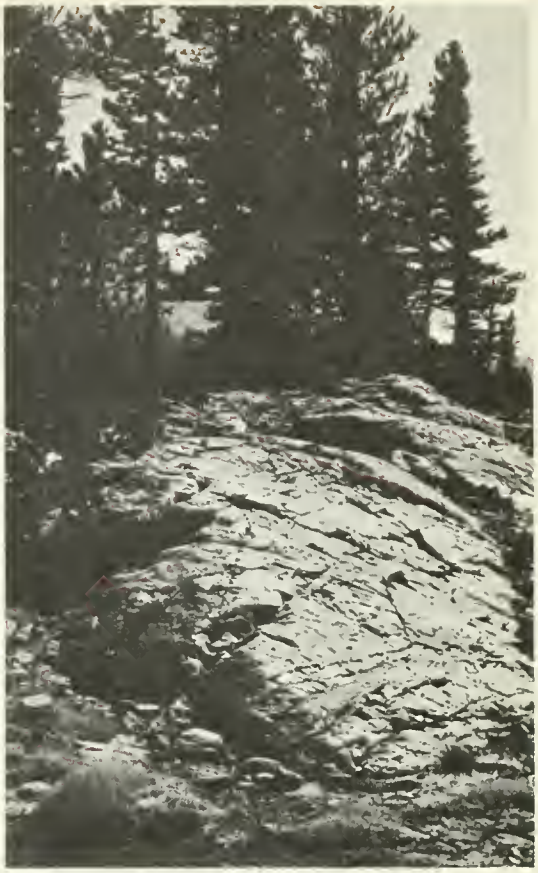
The trip to Saddlebag Lake is a slow but easy trip along the side of Tioga Peak, partially through superb groves of lodgepole pines. In places the trees open up to provide vistas across a great open valley to White Mountain and Mount Conness, with their many intricately carved glacial cirques. The lake, another manmade one, is very dramatic, surrounded by high rock ridges and battered whitebark pines. Here a Forest Service boat concessionaire takes backpack parties to the Hoover Wilderness at the north end of the lake.

It was approximately over today's route to Saddlebag Lake that the Tioga Mine crew traveled its last lap when it brought in the machinery for digging its tunnel. When it was decided in February 1882 that it was impossible to get the shaft as deep as it should go with hand labor, 16,000 pounds of machinery was brought up Mill Creek Canyon in March and April. A single pair of mules and about a dozen men hauled the equipment, loaded on homemade sleds, through snowbanks and up several thousand feet of precipices and impossible grades, mostly by block and tackle, a few hundred feet a day. Carrying their bedding and cooking equipment along, they made camp each evening. The nine-mile trip took slightly more than two months.

The Inyo National Forest nature trail in the Tioga Tarns area is delightful. A few steps from the road, across a low ridge, and all signs of civilization are gone. There are several tarns, each in its own little basin, surrounded by ridges of resistant rock the glacier failed to wear down to the level of the valley floor. Here are some fine lodgepole and white-bark pines, and in July and August an outstanding display of high mountain wildflowers. In the mud along the shoreline you may see a cougar's tracks. The Forest Service has marked the spots of special interest with small wooden plaques.

For the more ambitious outdoorsman, several of the surrounding peaks are easy climbs. The crest of Mount Dana, over 13,000 feet high, is only about 2½ miles from the highway as the crow flies, and only a little over 3,000 feet higher than the road here. Although somewhat more than 2½ miles on foot, the climb up the ridge to the summit is not difficult, and the view from the peak is superb. An easier project is the Dana Plateau, just to the east of the peak, a climb of about 1,300 feet. Of course, from this portion of the Sierra, there is access to a big portion of the High Country, but the average traveler will have time for just a quiet sojourn of a few hours, perhaps on his way north or south on US 395. This the improvements in Route 120 will make infinitely easier.

Granite outcropping which resisted abrasive action of glacier remains as mute evidence of its passing, its polished surface gleaming in the sun.



View of north side of Tioga Pass, one of the tarns in the foreground. This country was prospected almost inch by inch in 1870's and '80's.

Perfect example of glacial cirque to be seen from road to Saddlebag Lake. Glacier gradually "ate back" into ridge, creating vast amphi-theater or classical "circus arena" effect. Peak at right is Mount Conness.

On the far left a view of Mount Dana framed by lodgepole pines, with one of the Tioga Tarns at right. This is virtually by road-side of Route 120, seen as light line across middle of photo.

LEFT: Although not as common as lodgepoles, dramatically picturesque whitebark pines add considerable interest to the terrain at Tioga's summit. Peak in background is Mount Dana.

winter maintenance

AN ALL-YEAR JOB

BY MARCIA J. MICKELSEN

Snow falls on approximately 35,000 square miles in California, and from time to time nature's white coverlet envelops about one-fifth of the state where the elevation is 5,000 feet or higher. This necessitates snow removal on about 2,740 miles of state highway, from Mount San Jacinto in the south to Mount Shasta in the north, which in turn involves the seven highway districts in the easterly half of the state.

For some people, getting ready for winter was a simple task: They put up storm windows, added antifreeze to the car, and changed to a winter wardrobe.

For the Division of Highways, getting ready for winter was like getting ready to clear a colossal driveway over and over again. To prepare for this annual long sweep, some activities were begun as long ago as last March. In the time that followed, hundreds of projects were carried out, and the same is true every year. November 1 is always circled as the cutoff date—after that possible snows could make getting ready for winter an afterthought spelled disaster.

This 19-ton rotary plow is used in areas of combined heavy snow and high traffic volume, such as Interstate 80 in the high Sierra.

This machine, same as above, can throw up to 2,200 tons of snow per hour. Power comes from two diesel engines (220 horsepower for propulsion and 335 horsepower for feeder and rotary blades).

Some idea of the hustle-bustle a heavy snow fall brings about is indicated by a score of ready-to-go vehicles ranging from rotary plows to sand spreaders and snow loaders.

Several passes on state routes—Carson, Ebbetts, Sonora, Tioga, and Monitor—are not included in snow removal operations. The elevation and weather at these points is such that winter maintenance is too dangerous and too costly to pursue. On the average, these passes are closed in late November and reopened around Memorial Day, but portions of these routes below the passes are usually open for recreational purposes.

In spite of the closure of these passes, there are still plenty of roads to clear. All major highways, including Interstate routes 5, 8, 15, and 80, are kept open in all but the most extreme conditions by crews working out of 69 winter maintenance stations. Many of the maintenance stations are far removed from population centers. Some, perched high in the mountains, bear fascinating names such as Eskimo Summit, Dead Horse, Keen Camp, and Fawnskin. These stations are the "hubs" from which the men propel the big orange snowplows out to and down the roads, and to which they return after a 12-hour shift or combat with nature.

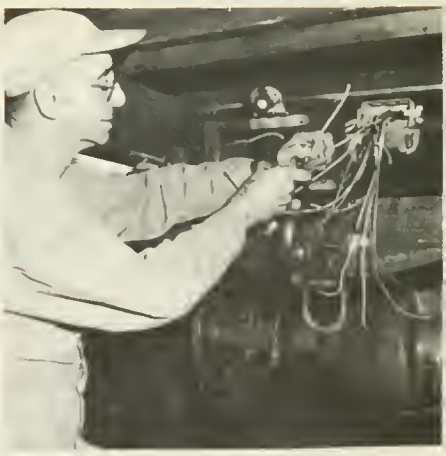
The first flurry of white crystals sets the snow crews to work with a full array of equipment. The state has 440 snowplows of several types, 179 motor graders, and 666 pieces of allied equipment such as sand spreaders and snow loaders.

It takes a massive grader and lots of power to push snow from the traveled way.

When the force of a particular storm subsides and the roadways have been cleared, the crews use the reprieve for repairs incidental to bad weather. They replace snow poles, unplug snow-packed culverts, restore sight markers and fixed objects (damaged by motorists when visibility is poor), patch portions of blacktop damaged by tire chains, and spread sand to cope with the daily melting and freezing cycle.

Done on a day-to-day basis, these tasks are dwarfed by what took place before the snows had come. The snow stakes (which mark the highway in deep snow) were driven; altogether more than 88,000 were put in place; 129,000 tons of sand (enough to create a pile 100 feet high) were stored in sand bunkers; 11,000 tons of salt were toted to maintenance stations, and all equipment was inspected, overhauled and modified to improve the season's clearing operation.

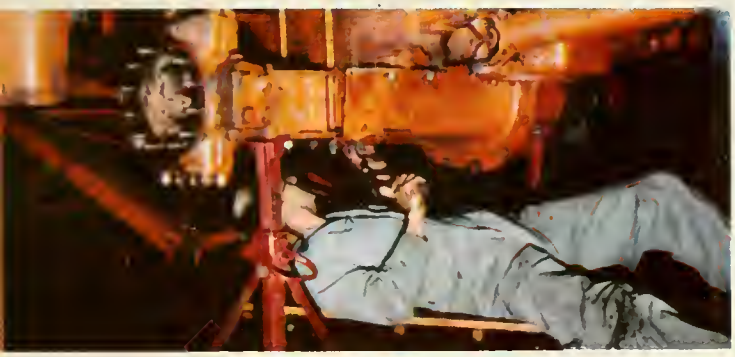
In mid-March, snow equipment slated for modification was shipped to the Equipment Department in Sacramento. Machine after machine was modified to increase its effectiveness in dealing with villain snow. Auger boxes were changed; larger fans in them help throw more snow. Diesel engines were installed. Conventional truck transmissions were replaced with power shift transmissions for more efficient operating and maneuvering. "No spin" differential modifications were made to enable a snowplow to move out of the way even with a broken axle, and improved power steering systems have given better maneuverability as well as reduction in operator fatigue. Only a few machines can be done at a time, but little by little all equipment is updated.

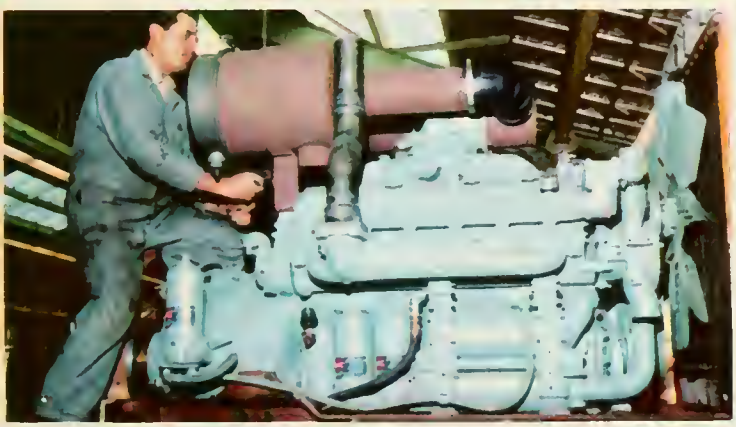


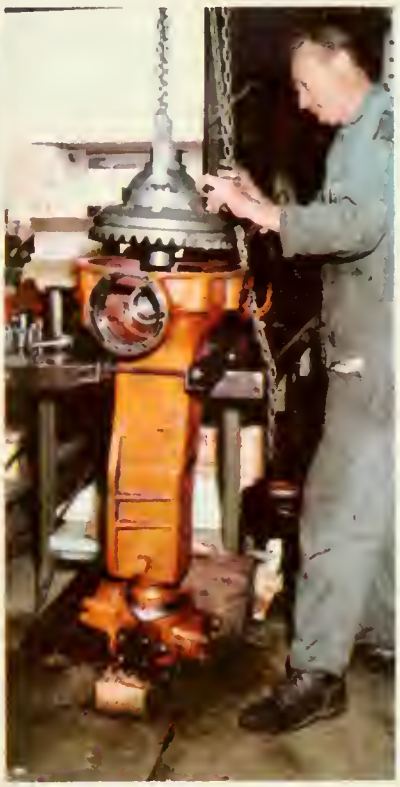
Chonging wiring on snow-going machines to synthetic rubber jacketing has prevented freezing and corroding that once made lights inoperable.

District 2 employees load cinders from bunker into waiting trucks while other men fill salt spreaders. Although the sky is blue in Susanville, traction materials may be needed upon very little notice.

Automatic snow stake driver was invented by District 9. Mechanism on front left wheel determined when next pole should be plunged earthward by the hydraulic rig. Workmen place one stake every 50 seconds for a daily total of 600.







JOHN MEYERPETER

At right, differential carrier and ring gear goes by chain into bearing cage midway in "no spin" installation operations. At top left, axle is bolted together and re-installed. At bottom left, welder fastens air cleaner brackets above new diesel engine.

Beating a November 1 deadline, modified rotary snowplow is trucked to its winter home at Kingvale. Machine will see duty on Interstate 80 near Donner Summit.

When roads are icy or snow is falling, the motorist may encounter signs which provide two choices: put on chains or turn back. Most go through the rigors of the former.

In areas without wide medians for snow storage, rotary plows funnel their intake into waiting snow loaders. The loaders then proceed to other areas where they deposit their winter bounty.

Chain control·stop point on Interstate 80 seems to feature some last-minute frolicking in snow as well as chain removal on westbound lanes. Motorists in eastbound lanes more seriously attack the problems of putting them on in order to drive over nearby Donner Summit (elevation 7,127 feet).

Rotary snowplows of lesser size than in previous pictures can also throw a mighty spray across the horizon. Machine capabilities have been increased through many modifications by the Equipment Department.

The Squaw Valley parking lot is filled to the brim by cars, skis, and skiers who arrive at this resort area by way of Interstate 80 and State Route 89 (south). The area, which lies southwest of Truckee, is best known as the site of the 1960 Winter Olympics.

Conway Summit maintenance station, elevation 8,138 feet, lies east of the main Sierra ridge (background) above Mono Lake. North-south traffic on U.S. 395 (foreground) is dependent upon clearing operotions of this District 9 station when snows come.

JOHN MEYERPETER

JOHN MEYERPETER

Interstate 80 eastbound lanes near Donner Lake are rapidly opened after a snowfall of less than major proportions. Clearing this transcontinentol corridor is facilitated by gently sloping grades designed for this new road.

The increased efficiency made possible by equipment changes is perhaps best shown by the fact that Interstate 80, opened over Donner Summit last year, was cleared without using any additional snowplows—yet there were twice as many lanes to clear as there had been on the old US 40.

All phases of getting ready for winter, as the transcontinental traveler, the trucker, the bus operator, and the ski buff can tell you, pay handsome dividends in winter mobility. The open road, flanked by walls of white, proves that demon weather can be successfully challenged.

Signs on turnobout mountings are inspected and repaired each fall. When Route 20 east of Nevada City is clear, Highways personnel turn sign to present a blank foce to the motorist.

STOP
VEHICLES WITHOUT CHAINS ON REAR WHEELS PROHIBITED
DEPT OF PUBLIC WORKS, DIVISION OF HIGHWAYS
SPEED-LIMIT
25
MILES
CHAINS
ADVISABLE

combating snow

via radio

By Alice Wiegand

New over-the-snow vehicle will enable communications specialists to service unmanned radio repeater station network despite heavy snow.

On left is one of six radio repeater stations in the District 3 network. Built on mountain peaks, these units support antenna and reflector dishes sending radio and microwave signals to highways units in 11 counties. Mrs. June DeVore, dispatcher (above), gives complete road/weather information to field workers and highway officials using a three-way combination of telephone, VHF radio and microwave.

(Editor's Note: This story about communications in District 3 holds true for all highway districts in California which have mountain roads to maintain.)

The radio communications network used by the Division of Highways at no time serves with more frequency or urgency than during snowstorms or low-visibility periods when mountain travel is hazardous and traffic must have safe passage over the Sierra Nevada range.

The mile-and-a-half-high granite passes pierced by US 50 south of Lake Tahoe and Interstate 80 north of the lake, are under constant surveillance by highway maintenance men and their supervisors who can relay any change in road conditions instantly. They use a communications system combining direct telephone lines, high frequency radio and microwave. The three-way combination is used because of its economy, flexibility and time-saving efficiency.

The network is centered in Marysville, headquarters for Highway District 3, and it links 16 base stations, over 200 mobile units and 6 radio-repeater microwave stations. These effectively blanket the 12,600 square miles and the 1,400 miles of state highways inside the district's boundaries which include the only two major trans-Sierra routes in northern California.

The repeater stations bounce radio signals beamed to them and are, therefore, located on remote mountain peaks where reception is good but access to them difficult.

Although they are serviced monthly, severe storms, high winds and ice sometimes interrupt the power and for these emergencies the stations are fortified with emergency generators.

In order to improve maintenance of them and to reduce hazard of power failure at these units, a new vehicle with wide tracks for over-the-snow mobility has been purchased for the radio communications department in Marysville. It will permit technicians, for the first time, to have their own means of transportation to the isolated relay stations.

Up to this year the specialists have been hitchhiking to remote stations whenever snow vehicles operated by other public or private agencies made a trip. But the trips did not always coincide with Division of Highways' emergencies!

A soundproof, dustproof studio at Marysville highway headquarters is the nerve center for the radio communications network. There, a skilled, competent dispatcher, Mrs. June DeVore of Sutter County, maintains constant contact with all stationary and mobile units.

Mrs. DeVore is able to keep state offices, including Sacramento headquarters, informed of highway conditions, including those over the Sierra, which are constantly changing during inclement weather.

Public news media have immediate access to this information.

Two important installations which are vital to the smooth flow of trans-Sierra traffic are remote-control signs, one on US 50 at Placerville and the other on Interstate 80 at Colfax. Black with white letters, the signs are blacklighted for high visibility day or night. Six messages are stored on each sign, and, when activated by special coded dialing, flip into place advising motorists of chain requirements and road conditions over the mountain summits. Great timesavers, they are the best known means for conveying instant information to the motorist.

The highway division is charged with responsibility for maintaining a safe and orderly progression of traffic for the 7,000 to 9,000 motorists who daily drive over the crest of the Sierra in winter on Routes 50 and 80. While no amount of equipment can forestall road closures, the use of it by highly trained men and women enables the highways' communications staff to advise motorists in advance of the caprices of nature which may impair safety.

SOUTHERN CALIFORNIA

STORM DAMAGE

By Paul Brown

Resident Engineer John Feenstra (above) inspects a maintenance truck buried in mud on Route 111 near the Interstate 10 junction. A total loss, this truck was the only vehicle damaged in the storm. No one was reported injured. At left, a mangled reminder of the storm had been a bridge (located at Snow Creek near Windy Point). It collapsed when floodwaters washed out falsework.

In the series of storms which struck Riverside and San Bernardino Counties last November, Division of Highways maintenance crews, working around the clock, struggled mightily to keep the roads open despite flooding, washouts, and slides. Occasionally they looked up from their work and peered into the darkness, trying to see the huge boulders they could hear bouncing and grinding their way down the hillsides nearby. When the storm passed it left a nasty trail of mud, rock, and debris over the highways.

Surprisingly, not a single State Division of Highways maintenance or construction man was injured during the storm—which, although it lasted a week, concentrated its destructive force into a two-day period, November 22 and 23.

The storm did not single out one spot, but hammered away at a multitude of locations throughout Riverside and San Bernardino Counties. There were two areas which received severe punishment. One of these—the most severely damaged area in the two counties—was at Mill Creek on Route 38 in the San Bernardino Mountains. Water roaring down the creek bed broke through the dike and undermined the roadway. About 500 feet of road was lost in one area; and the storm wiped out approximately 800 feet of roadway at another section.

The second severely damaged area was located on Interstate 10 and Route 111 near Palm Springs. Flood waters pouring out of the mountains dumped heavy quantities of mud and debris on Interstate 10 along a two-mile section stretching westerly from the Route 10/111 junction. Route 111 near the junction also was buried in mud and debris.

About 100 cars and trucks were stuck in the mud in this area. Mud on the highway was three to four feet deep in some spots.

The storm also left its mark at Snow Creek near Palm Springs on Route 111. A contractor's bridge, under construction on a new project at this location, collapsed when falsework washed out.

During the storm, maintenance crews closed sections of roads and made detours, as necessary. There were 22 closures (including opening and reclosures on the same locations). Sixteen of these were in San Bernardino County.

The cost of damage to state highways was about $600,000, of which about a third was for emergency openings. Riverside and San Bernardino County roads suffered about half this amount each. (Damage in Ventura County from the same series of storms was about $175,000, although damage to the state system there was relatively negligible.)

Both Riverside and San Bernardino Counties' boards of supervisors asked the Governor to declare the counties as disaster areas. This was done.

The maintenance crew at the Panorama Station (on Route 18 in the San Bernardino Mountains) keeps a record of precipitation at that location. During the entire year of 1964, the rainfall total at the Panorama Station was 19.7 inches. The rainfall total for just the month of November 1965 at the Panorama location was 21 inches.

Camino-Pollock Pines Freeway

Rural freeway bypassing Pollock Pines carries average daily traffic of 11,500 vehicles in peak period.

Tranquillity of small community returns as new freeway opens

By Ray Sorum

Heavy traffic on US 50, California's first state highway, has been commonplace for a hundred years, and during those years it has bit by bit been changed from a winding, dusty, freighters' haul road to a modern highway. Today, with the route still increasing in popularity, US 50 is being converted to freeway as rapidly as availability of funds allows. The latest unit in this transition is 6½ miles completed in late summer last year, bypassing the communities of Cedar Grove and Pollock Pines, and relieving the serious bottleneck which has traditionally developed in the latter community on weekends and holidays.

In the late 1850's this route was the main connection between Sacramento, Placerville and Nevada's Comstock mines. By the 1860's uncounted hundreds of freight wagons rolled over its dirt and corduroy surface with cargoes ranging from drygoods and flour to blasting powder and whiskey.

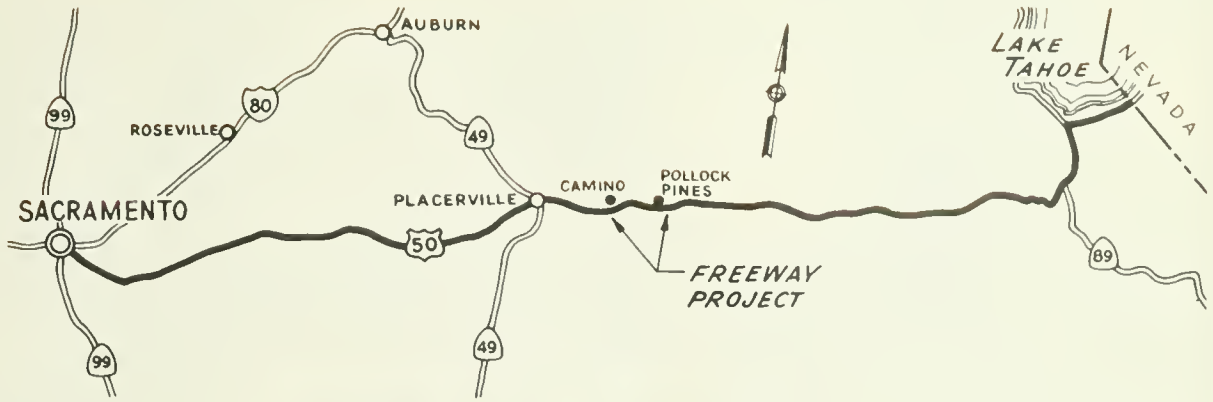
Traffic was said to be so heavy that it was "nose to tailboard" and that if a wagon dropped out of the traffic stream "it waited until nightfall to get back into line."

The road was first opened between Placerville and the Carson Valley in Nevada in 1852 by Col. J. B. Johnson and with a few deviations from its original location has become US 50.

The first stage line between Placerville and the railroad at Folsom began operation in 1857 and improvements began to follow with moneys subscribed by El Dorado, Sacramento and Yolo Counties. Construction during 1860–65 fixed the location for what came to be known as the "Lake Tahoe Wagon Road" for more than 60 years.

Tolls were collected on the road between Smiths Flat (near Placerville) and the Nevada state line until 1886 when the rights were purchased by El Dorado County and the route declared a public highway. In 1895 it was officially designated as the "Lake Tahoe Wagon Road" and the following year became the first state road in California.

In the intervening years the old wagon road became a federal aid route, getting its US number, and today is a vital east-west highway which serves the popular Lake Tahoe resort area as well as the year-round recreation areas



Project limits were from 0.3 mile east of Camino to 1.1 miles east of Sly Park Road.

At left: In 1963, traffic through residential area was heavy. Bottom: Now, two-thirds of the cars use the freeway.

in eastern El Dorado, Placer and Nevada Counties and the State of Nevada —including fishing, hunting, camping and hiking, skiing, water sports, sightseeing, or just plain loafing at summer homes and resort hotels.

Another freeway section, between the Folsom Junction and the vicinity of Clarksville, was opened to traffic last November. The adjoining two miles east of Clarksville will be completed later this year, which will make a continuous 15-mile eastward stretch of four- and six-lane freeway from Rancho Cordova on the outskirts of Sacramento.

The Pollock Pines section completes a stretch of 25 miles of four-lane highway between Missouri Flat Road, three miles west of Placerville, and Riverton in the center of the county where the road crosses the American River's south fork. Interchanges were built east of Camino, which was bypassed by four-lane construction in 1958; near Sportsmans Hall between Cedar Grove and Pollock Pines; and at Sly Park Road near the end of the job not far from the eastern limits of Pollock Pines.

The $4½ million cut-and-fill project was built by Granite Construction Co. of Watsonville. Work started in March 1963 and was completed in August 1965. Ribbon-cutting and dedication ceremonies were held July 28 under the sponsorship of the El Dorado County Chamber of Commerce.

Average daily traffic through the Camino-Pollock Pines corridor is about 8,000 vehicles. Peak month ADT is 14,100 with approximately 11,500 vehicles of this total using the freeway. The remainder is local traffic using the old road.

Using recent traffic counts, savings to motorists are in the neighborhood of $1,000 per day average. Based on an estimated 5 percent traffic increase per year, this will amount to $12,400,000 in savings to the traveling public over the next 20 years.

Time saved will add up to roughly 130,000 traveling hours per year, based on the fact that the average 40-mph on the old route will rise to a 55-mph average on the new route.

On the old road, within the project limits, there were 59 accidents in 1963 and 72 in 1964. Based on years of statewide experience, opening of the freeway will reduce this by two-thirds.

MARIPOSA

and their do it yourself roadside beautification

Take 25,000 empty two-pound coffee cans, a like number of redbud seeds, add a state highway and mix with the ingenuity, nursery knowhow and enthusiasm of a community and what have you got? Perhaps the biggest do-it-yourself roadside beautification program in the history of California.

The community is the City of Mariposa and the state highway is Route 140, a main entry point into Yosemite National Forest.

The project had its beginning in 1964 with William Brady, who had the thought of planting redbud shrubs throughout the county. Brady, an amateur horticulturist, had developed a successful germinating process that can simulate—in a two-pound coffee container—conditions found in nature. When Brady and a friend, Keith Kaylor, passed the idea on to various civic groups, the Mariposa Chamber of Commerce and the Highway 140 As-

Rows of redbud seedlings are nurtured for their eventual planting to beautify Route 140.

Governor Edmund G. Brown accepts a redbud plant from William Brady. Mrs. Brady watches with Robert Romaine (center right), president of the Highway 140 Association, and Roy Radanovich (right), the group's publicity charman.

sociation agreed to take over.

Last spring they made a nationwide appeal for people to send them empty coffee cans. Thousands were received with many coming in by parcel post. The project seemed to sound a particularly responsive note in Brooklyn for many were forwarded to Mariposa from that city. But Air Force bases, schools and civic groups from all over the nation also responded with bulk shipments.

Since then 8,000 shrubs have sprouted and are being planted. The first was emplanted in a permanent place of honor adjacent to Route 140 during ceremonies on September 21.

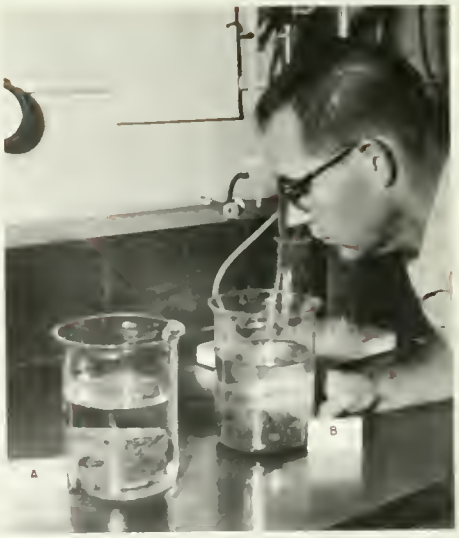
The date coincided with National Highway Week and the California Division of Highways took cognizance of the project by issuing a permit authorizing the planting of a single redbud. Later, a permit covering the remainder of the thousands of shrubs was mailed to the chamber of commerce.

The project has received recognition from numerous officials and private citizens who are interested in beauty. Included are Mrs. Lyndon Johnson, Governor Edmund G. Brown and California's State Highway Engineer, J. C. Womack.

In a letter to the Highway 140 Association, Governor Brown said, "Alaska and Texas may dwarf California in mere geography, but when a group of our citizens envision and carry out a plan such as yours, it again proves that California is second to none in noteworthy accomplishments and love of beauty."

Brady prepares the soil for the planting of the first redbud at a special ceremony in Mariposa.

LIME STABILIZATION



Experiment on cohesiveness of lime-treated clay. Specimen A was kept damp before immersion; specimen B was allowed to dry before immersion. Note B's more rapid disintegration.

PHOTOS LEFT, TOP TO BOTTOM. A tank truck spreads lime slurry in an area where lime dust could cause damage to airplanes stored nearby. SECOND PHOTO—Mechanical road mixing of lime with damp aggregate. THIRD PHOTO—Large tank truck and spreader used in laying dry lime. BOTTOM PHOTO—Dry lime is converted into slurry in mixing tank.

California's Experience With Lime Treatment in Road Construction

By Ernest Zube and Clyde Gates

Introduction

Highway engineers are constantly seeking better and more economical ways of building highways which will safely carry traffic and give more years of service with a minimum of maintenance. This is a never ending job. Design criteria have had to be modified as traffic, and particularly wheel loads have increased. Specifications for road-building materials have had to be more rigid as the supply of good roadbuilding materials becomes scarcer. New materials have had to be found and methods of treating or stabilizing the poorer materials have had to be developed. Newer and better methods of construction have had to be developed.

Rock, stone, gravel and sand have long been used successfully and economically for road building. While these materials are plentiful in many areas of California, there is a scarcity in certain areas. Many of the good sources of aggregates are being depleted or fail to meet the rigid specifications required for modern road building. Urban expansion and zoning ordinances are limiting the development of new sources. In recent years it has become quite obvious that methods of treating or stabilizing local available soils would have to be developed.

Clays or clayey soils are usually quite abundant in areas where good natural roadbuilding materials are scarce. This aggravates the situation, since clays have little load-carrying capacity when wet and therefore require blanketing with thick roadway structural sections. Many methods of waterproofing with bituminous products or stabilizing clays such as blending with better aggregate have been tried but most have been impractical. The most promising stabilizing agent, in recent years, has been hydrated lime. The results in many cases have been phenomenal. These problem clays can now be converted into stable bases and subbases and used in the structural elements of modern highways.

History

The use of lime for the stabilization of soils is not new. Lime is actually one of the oldest man-developed construction materials. Early history does not record the first use of lime stabilization. However, it is known that mixtures of clay and lime were used in constructing the pyramids of Shensi in the Tibetan-Mongolian Plateau more than 5,000 years ago. The Romans used lime in subbases of many of their roads, including the famous Appian Way.

Some interest was shown in lime stabilization in the United States about 40 years ago. A few small experimental projects were constructed but soon failed due to the lack of proper wearing surfaces. The first real lime stabilization project was consrtucted in 1943 by the Corps of Engineers. Two percent of hydrated lime was used to reduce the plasticity of a caliche gravel used as a base course for runways and taxiways at Chase Field in Texas. Since that time the State of Texas has been a leader in the use of lime stabilization.

In the late 1940's the California Division of Highways became interested in lime stabilization. Our Highway District 3, with headquarters at Marysville, was very progressive in its application. Many projects, some of a maintenance nature, were constructed in El Dorado, Placer, and Sutter Counties. The ready availability of a cheap waste lime in this area made its use particularly attractive from an economical standpoint. Two small experimental projects constructed in the Sierra, one near Truckee and the other near Georgetown, were particularly successful * and led to the use of lime on further projects. At the present time, lime is being used on more and more projects by counties, cities, and the state. It is estimated that lime treatment has been used on more than 200 projects in California. Over 600,000 tons of lime were used for stabilization last year in the United States.

Lime Reaction

There are two main chemical reactions which take place when lime and water are added to clayey soils. The first is an agglomeration of the fine plastic clay particles into coarse friable particles through a phenomena called base exchange. This action is rapid and is usually completed within an hour or two if the soil is pulverized and thoroughly mixed with the proper amount of lime and water. The second action is a cementing or hardening action in which the lime reacts chemically with available silica and some alumina in the raw soil forming calcium silicates and aluminates. This is a slow action which continues for a period of a year or longer providing there is adequate moisture available.

Types of Lime

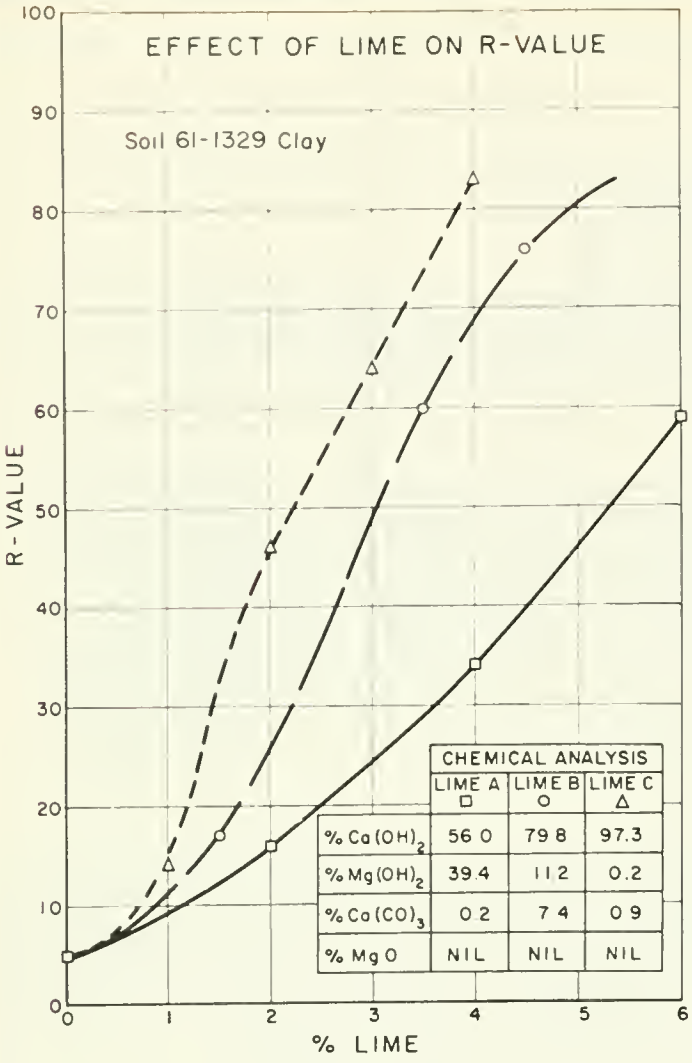
Ground or pulverized limestone is often called "lime." However, when we speak of lime for soil stabilization, we think primarily of calcium hydroxide. Limestone is calcium carbonate and has little or no chemical reaction when mixed with clay soils. When calcium carbonate is heated to a temperature of about 1,800° F., carbon dioxide is driven off and calcium oxide, commonly called quicklime, is formed. Quicklime is quite effective for soil stabilization but is dangerous to use and can produce severe burns when in contact with moist skin. Calcium hydroxide is formed by adding water to quicklime. Calcium hydroxide can also be produced as a byproduct in the manufacture of acetylene and carbide. Calcium hydroxide is the type of lime normally used for treating soils in California. Another type of lime, produced from dolomite, is normally a mixture of magnesium hydroxide and calcium hydroxide and is called dolomitic lime. It has also been used for stabilizing certain types of clays.

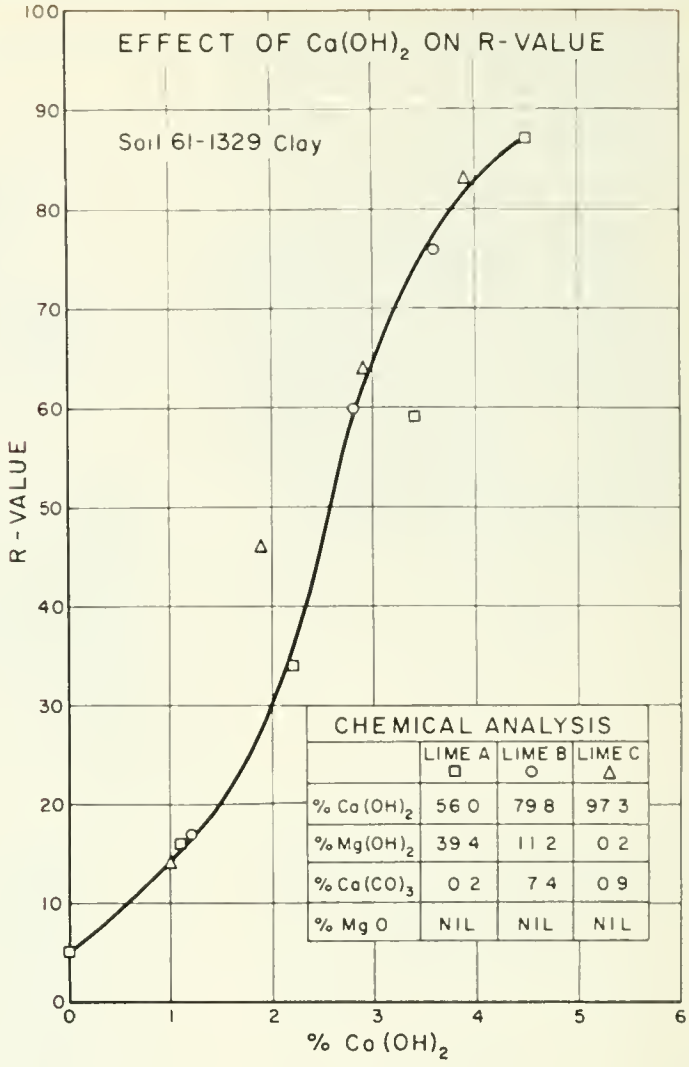
Uses of Lime in Highway Construction

The most common use of lime treatment or stabilization in highway construction is for subbase. Normally the "in place" clayey soil or a locally imported soil is treated with about 3 or 4 percent of lime, by weight of the dry aggregate. The R-value of the untreated soil is frequently as low as five and after lime treatment the R-value is usually well above 60. This type of treatment has been used successfully on many projects. (R-value is resistance to deformation.)

Graded aggregates which contain plastic fines can be treated with lime and used as base material. Even heavy clays have been treated with lime and used as base material on secondary roads having light traffic. However, experience with this latter type of design is limited, especially insofar as heavy traffic is concerned. Laboratory tests indicate that the R-value of many clays, when mixed with from 4 to 6 percent lime, can be raised to 80+. However, designers should proceed with caution until more information is available on field performance. Several experimental projects are under-

* *These projects described in article entitled "Experimental Use of Lime for Treatment of Highway Base Courses" by E. Zube*, California Highways and Public Works, *July–August 1950.*





way to gain objective knowledge in this area.

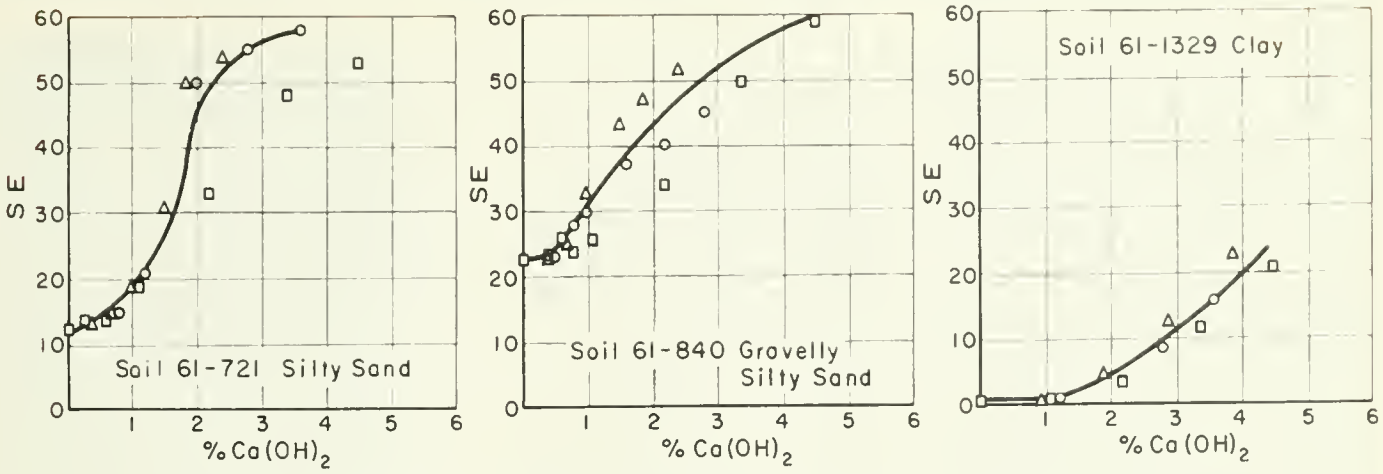
Another use of hydrated lime has been for the treatment of expansive clay soils under portland cement concrete pavements. The lime reduces the expansion of the treated layer and also serves as a moisture barrier, thus preventing water which might enter joints or cracks in the pavement from getting to the expansive clays in concentreated amounts and raising the joints. By using lime treatment it is often possible to decrease the thickness of aggregate subbase by as much as two feet, thus effecting a substantial saving in cost.

Lime is also used successfully for treating wet subgrades which will not support construction equipment. The lime not only blots up some of the excess moisture but also stabilizes the layer to which it is added. Therefore, lime treatment of wet subgrades can speed up construction by negating the need for extensive digouts or delays in drying operations.

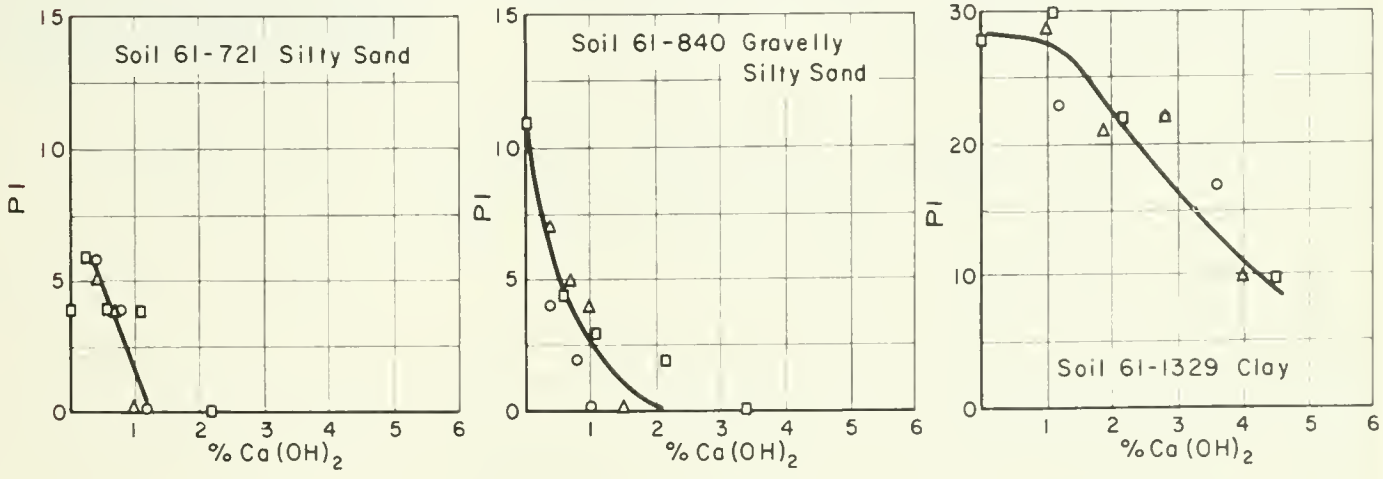
In certain areas of California there is a scarcity of good mineral aggregate for asphalt concrete. One such area is in Modoc County where asphalt concrete pavements, using highly absorptive local aggregates, have shown early failures due to stripping, raveling and cracking. Texas has had similar problems with their aggregates in the Panhandle area. They found that lime treatment of the mineral aggregate, before the addition of the asphalt, corrected the problem. Therefore, it was decided to use this method of treatment on a project just completed in Modoc County near the town of Likely. One percent of hydrated lime, in a slurry form, was added to the mineral aggregate before it passed into the drier. Laboratory tests show that the lime treated aggregate has satisfactory resistance to moisture.

About two years ago the Oklahoma Highway Department developed a new maintenance technique referred to as "drill-lime stabilization" for correcting both distressed flexible pavements and sliding highways fills. With this technique, hydrated lime is introduced into the wet unstable plastic subgrade by means of holes drilled through the pavement. It is claimed that the lime permeates through the subgrade, stabilizing it to the extent that further distress is minimized or even stopped. The holes are usually about nine inches in diameter and about 30 inches deep and spaced on approximately five-foot centers. About one-half sack of lime is poured into each hole, water added and the holes backfilled, tamped and patched. In California, at least three

EFFECT OF CALCIUM HYDROXIDE ON SAND EQUIVALENT



EFFECT OF CALCIUM HYDROXIDE ON PLASTICITY INDEX



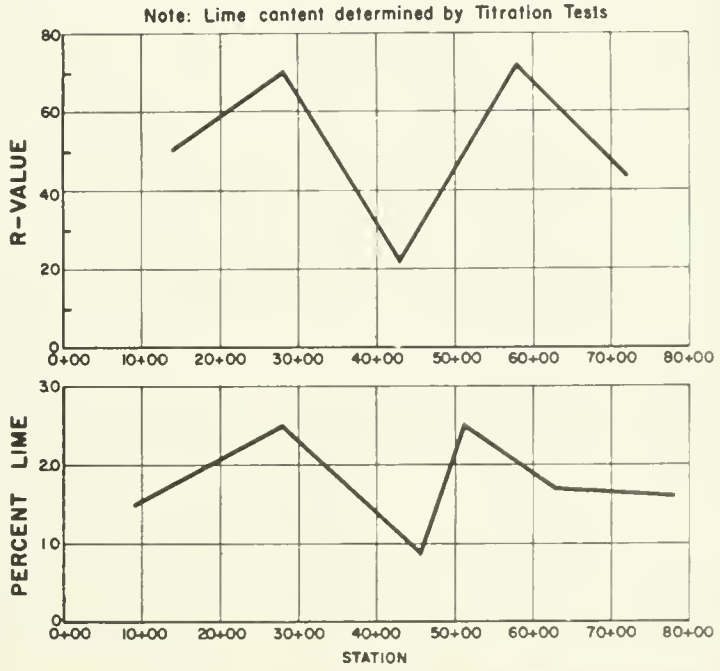
small projects with drill-lime have been constructed, but it is too early to determine their success.

On a recently completed freeway in the Sierra, a large side hill fill began to show signs of slippage after a wet winter, with failure apparently imminent. Horizontal drains were installed to remove as much water as possible. As an added precaution, six-inch-diameter vertical holes on five-foot centers along both shoulders, were drilled through the fill, some to a depth of 70 feet, to intercept the potential slippage plane. The holes were filled with a thick lime slurry and again refilled after a period of standing. The fill has now gone through another winter without failure. It is recognized that the horizontal drains had the most effect on the stabilization, however, we feel that the drill lime contributed somewhat to the stabilizing effect.

COMPARISON OF LIME CONTENT WITH R-VALUE ON STREET SAMPLES OF LIME TREATED SUBBASE

MATERIAL FROM ALTHEA AVENUE, FRESNO COUNTY PROJECT

Note: Lime content determined by Titration Tests



Hydrated lime can be used to reduce frost damage in subbases and basement soils. At the Wingate Ordnance Depot at Gallup, New Mexico, lime treatment of existing base course materials eliminated frost-heaving damage on roads which previously had perennial problems of frost heaving. Luckily in California frost heaves are a minor problem.

Construction Details

The construction procedure for lime treatment is similar to that used for road-mixed cement treatments. The only difference is that lime treatment is not as critical to mixing delays.

The soil or aggregate, either material in place or imported, is brought up to the proposed finished surface of the layer to be treated and then rolled. The compacted surface is carefully trimmed to grade so as to provide the proper amount of material for lime treatment. The aggregate is then loosened to the proper depth. Dry clayey soils should be premoistened to facilitate pulverization of clods.

Lime, in either the dry form or in a slurry, is spread in carefully measured amounts. Mixing is then accomplished by a road-mixing machine which adds the required amount of water during the mixing operation. If clay lumps persist after the first mixing, the material should be allowed to "mellow" for a day or two and then remixed.

The distribution of lime is checked by the titration test method No. Calif. 338. If the lime content varies more than 0.6 percent lime from the planned lime content, the cause is determined and corrective measures taken before proceeding with further operations.

After the mixed material has set long enough for the clay to become nonplastic, sometimes only an hour or two, the material is spread to the required thickness and compacted.

Compaction should be accomplished within 48 hours after the addition of lime and water to the soil or aggregate. Measurable reduction in quality takes place with certain types of soils when delays in compaction exceed 48 hours.

Good compaction is essential for best results. A sheepsfoot or segmented roller is best for initial compaction to insure good density in the lower portion of the layer. The final rolling can be accomplished by pneumatic-tired or steel-tired rollers.

Compacted lime treated soils should not be reworked after the material has been compacted and cured for a few days. This reworking disrupts the cementing action and permits additional carbonation of the lime. Therefore, there is less available lime for further cementing action. The reworked material will usually have lower strength than the undisturbed material. If reworking is necessary, additional lime and water should be incorporated before recompacting.

Lime-treated soils should not be permitted to dry out after mixing. The chemical action not only ceases when the lime dries but some carbonation of the lime takes place, thus preventing a complete return of the chemical action when water is again added. California specifications require the compacted lime treated material to be kept damp until such time as the curing seal is applied. Liquid asphalt MC-250 is normally used for the curing seal.

Research

The Materials and Research Department of the Division of Highways has been interested in lime stabilization for many years and has been exploring the possibilities of expanding the use of lime for various types of construction. Several research projects have been undertaken.

In 1961 a research study was undertaken to determine the effect of the calcium hydroxide content upon stabilizing ability of lime. This study revealed that the higher the percentage of calcium hydroxide, the greater the improvement in R-value, sand equivalent and plasticity index. The results shown in Figures 1, 2 and 3 taken from a paper presented at the University of the Pacific,* shows some of the data.

The early specifications for lime in California called for a minimum of 85 percent calcium hydroxide. However, this required a high grade limestone to be used. An economic study in 1962 showed that a saving could be made by lowering the calcium hydroxide requirement to 75 percent minimum, thereby permitting the use of lower grade limestone, but requiring the use of a little more lime.

Several years ago a titration test, test method No. Calif. 338, was developed for determining the percentage of cement or lime in treated soils and aggregates. This test has been very helpful for controlling cement and lime distribution during construction.

The use of lime for treating expansive soils, when used under portland cement concrete pavements, was the subject of a research project during the past year. While the project is not completed, the results have shown conclusively that lime treatment of a six inch layer of clay is effective in eliminating the expansion of the layer and also in forming a barrier for preventing water which enters joints and cracks in the pavement from getting to the expansive basement soils in concentrated amounts.

A research project is now underway on a current construction project for determining the benefits of using a lime treated heavy clay for base and subbase under an asphalt concrete pavement.

In the near future, it is planned to develop improved tests for a better evaluation of lime treatment. It is intended to explore present construction methods with the hope of improving uniformity of mixing. Another project that will be investigated is the basic reaction between lime and various types of clay.

Conclusions

Lime treatment provides a means of utilizing low-quality aggregates and soils in the structural design of highways. In many areas of the country this is important since good aggregates are not always available within reasonable haul distance. The decision to use lime treatment, in lieu of other types of construction, should be based upon economic cost comparison.

Not all types of soils and aggregates respond favorably to lime treatment. Lime treatment is most effective with clayey soils or gravel-clay mixtures. It can make the clays friable, reduce the plasticity index, increase the sand equivalent, increase the R-value and reduce the amount of volume change. Sands and the coarser silts are generally not benefited by lime treatment. Laboratory tests, such as the R-value (test method No. Calif. 301), should be used for determining the beneficial effects of lime treatment and the percentages of lime to use. Additional lime, usually about 0.5 percent, should be included to compensate for construction variations.

Good construction control is essential for consistent results. It is necessary that the proper amount of lime and water be used and that uniform mixing, proper compaction and adequate curing be maintained.

The use of lime in highway construction has increased during the last few years and will undoubtedly continue to increase as sources of good aggregates become scarcer.

California's Experience With Lime Treatment of Soils and Aggregates by Clyde G. Gates, Fifth Annual Highway Conference, University of Pacific, Stockton, 1962.

STATEMENT BY GOVERNOR EDMUND G. BROWN

I was grieved to learn of the death of George T. McCoy, former State Highway Engineer and Chief of the Division of Highways, who retired in 1959.

It was under Mr. McCoy's strong and capable leadership as State Highway Engineer from 1943 to 1959 that California attained a position of preeminence throughout the nation and the world in the development of freeways and other contributions to the economy, efficiency and safety of motor vehicle transportation so essential to the growth and welfare of our state.

It was given to him to be the one in charge of the vast expansion of our state highway system which represented the expenditure of more than 2½ billion dollars and construction of 2,300 miles of multilane, divided highways.

Mr. McCoy was accorded nationwide professional recognition and honor. He was elected president of the American Association of State Highway Officials in 1954. In 1958 he received the Thomas H. MacDonald Award for outstanding achievement in the development of highways.

His career reflected great honor on our state and its highway program.

Internationally Known Former State Highway Engineer G. T. McCoy Dies

A few years before her death a riter interviewed Mrs. Edith Wil-on McCoy on the subject of her usband, George T. McCoy, who t the time was the California State Highway Engineer.

"George has never been inter-sted in acquiring personal wealth," lrs. McCoy said.

"His life has always been on the dealistic side. He finds satisfaction i building something worthwhile nd enduring, and building it so as o do the most good for the most eople."

Although she preceded him in eath, Mrs. McCoy's words make n epitaph worthy of George T. lcCoy, who died Christmas eve, 965, at the age of 76.

There were many facets to the an. He was a classical scholar who pent eight years studying Greek nd Latin. He was an athlete who on college letters in football, bas-etball and track. He was an engi-eer and worked at his profession or more than 44 years—32 of them ith the California Division of lighways and 16 of those years 1943–1959) as State Highway En-ineer.

He was responsible for the spend-ng of more than 2½ billion dollars n tax funds during the period he erved as State Highway Engineer, nd he lived up to his Scottish ncestry by making sure that full alue was returned for every single ollar.

He tried to avoid arguments, de-ates and controversy. Neverthe-ess, McCoy was a master of logic nd always stated his recommenda-ions and position in a firm but oft-spoken voice.

McCoy was born on September 2, 1889, on a ranch near Milton, Oregon. After completing gram-mar school, he attended Pearson's Academy and Whitman College (both in Walla Walla, Washing-ton).

He graduated from college in 1913 with an A.B. degree, *summa cum laude*. It was at Whitman that he first became affiliated with Beta Theta Pi fraternity. The scholastic honor society, Phi Beta Kappa, did not have a chapter at Whitman dur-ing the years that McCoy attended, but when one was organized there in 1918 McCoy was one of those retroactively chosen for member-ship.

It was at Whitman that McCoy first met Edith Wilson, and when they graduated he proposed mar-riage, but she insisted that first she wanted to go to an eastern school for postgraduate work.

Going east fitted in with Mc-Coy's plans, for he, too, wanted to continue his education. Although his undergraduate work was pre-paratory to entering law school, McCoy had decided to switch to engineering and intended to enroll at Massachusetts Institute of Tech-nology.

But Edith Wilson had enrolled at Columbia and McCoy stopped off in New York to help his fiancée get settled. He never got back on the train but changed universities instead and graduated from his civil engineering studies at Columbia in 1915.

McCoy returned to the west coast, for Miss Wilson had joined the faculty of Spokane's College of Puget Sound. The couple were married in that city on April 3, 1916.

McCoy's first job in 1916 was as an instrumentman for the Washing-ton State Highway Department, and his salary was $65 a month. Of course there were fringe benefits such as assignments in 28 different locations the first year.

But the newlyweds found mov-ing wasn't difficult, for the high-way department furnished them with a tent that included a port-able board floor. A few packing cases that doubled as furniture car-ried their belongings safely to the next place they pitched the tent.

The McCoys kept on the move until 1927, for during those years he worked as a bridge engineer in North Dakota, as a highway engi-neer in Idaho and Montana for the federal Public Roads Administra-tion, and once again for the Wash-ington State Highway Department.

He remained with the organiza-tion until 1927 and then joined the California Division of Highways.

California's present State High-way Engineer, J. C. Womack, worked in close association with McCoy for a number of years.

"California will reap benefits from his highway planning for the next several generations," Womack said. "Every person who drives on the state highways is indebted to George McCoy, for much of the system's efficiency is directly at-tributable to the leadership and guidance that he provided for so many years."

John Erreca, the Director of the Department of Public Works, was a mayor and a county supervisor during some of the years McCoy served as State Highway Engineer.

"His integrity was his shield," Erreca said in describing McCoy. "It didn't matter how big or small a community's problem might be, if it had to do with highways, Mr. McCoy was anxious to know about it and help if he could.

"But there was one thing always certain. Political pressure wasn't going to sway him, for he had no pet projects. He was guided solely by the merits of each situation."

The Administrator of the Cali-fornia Transportation Agency, Robert B. Bradford, also was well acquainted with McCoy. "George McCoy was a quiet, modest person who made immeasureable contribu-tions to his adopted State of Cali-fornia. He will be long remembered by those who knew him as a man who willingly gave much and asked for little in return."

McCoy's contributions have re-ceived previous recognition. In ad-dition to serving as president of AASHO, he was the recipient of that organization's Thomas H. MacDonald Award in 1958. The MacDonald Award is presented for "outstanding service in highway engineering."

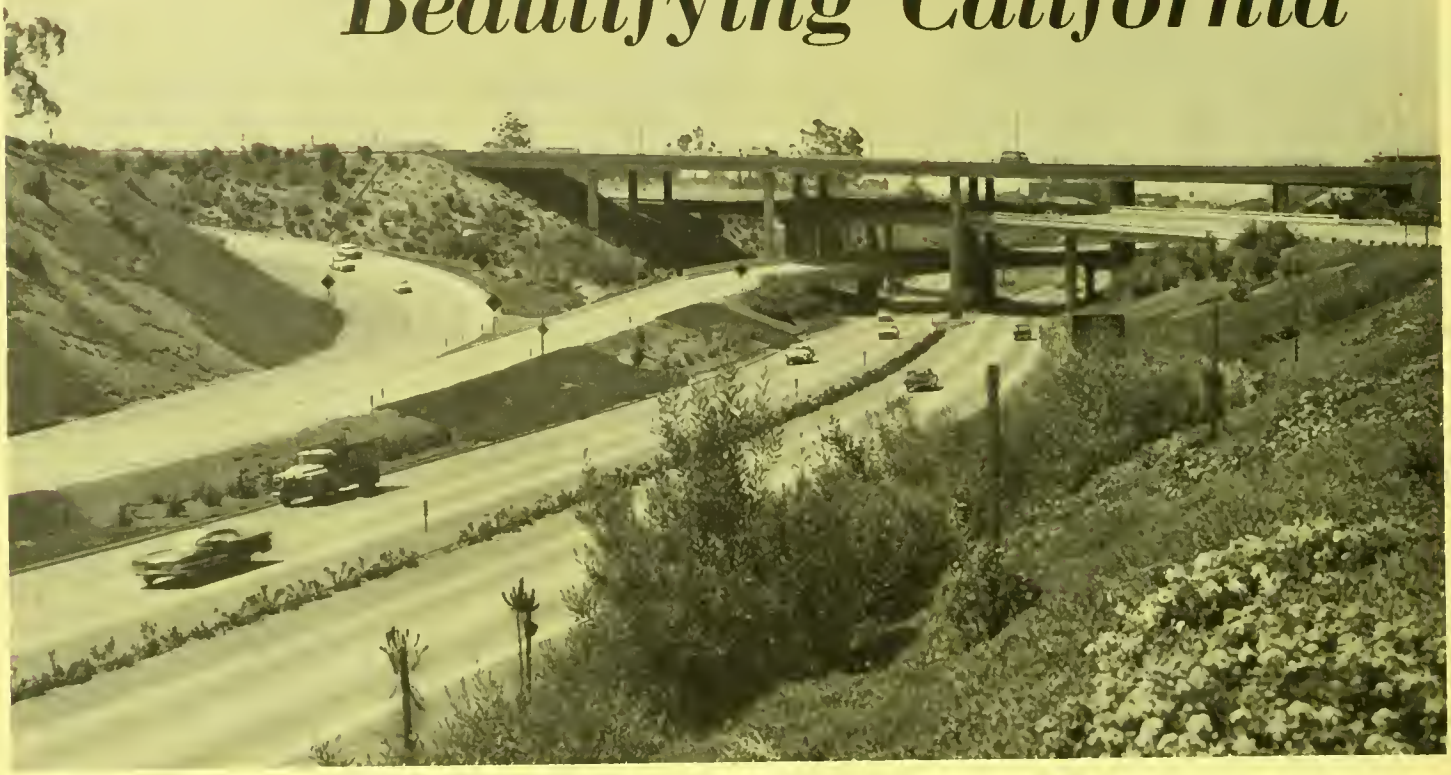
And just before he retired in 1959, separate resolutions honoring McCoy were adopted unanimously by the State Senate and the Assem-bly. House Resolution Number 346 was introduced by Assemblyman Vincent Thomas of San Pedro, and Senate Resolution 168 by Senator Randolph Collier of Yreka.

Both took note of the growth and progress of California highways during Mr. McCoy's 16-year ten-ure as State Highway Engineer and called attention to the nation-wide professional honors accorded to him.

Mr. McCoy is survived by a son, George T. McCoy, Jr., and two granddaughters. The younger Mc-Coy also is an engineer and resides with his family in Millbrae.

Funeral services were held in Sac-ramento on Tuesday, December 28, 1965.

Beautifying California



Four-level interchange in downtown San Diego at junction of Cross Town Freeway and US 395 through Balboa Park. Beauty of landscaping here was factor in award to District 11 from Downtown Improvement Association.

With additional funding for highway beautification, and more liberalized directives on the spending of these funds, activity in this facet of highway design has been considerably increased recently.

Typical of these activities are a recent award of the largest highway landscaping contract ever let in California; appointment by State Highway Engineer J. C. Womack of a special beautification committee in the Division of Highways; and substantial changes in the Division of Highways landscaping section.

The three-man committee to coordinate the division's efforts at highway beautification, and to develop special training in aesthetics for Division of Highways employees, is composed of Design Engineer A. C. Estep, Bridge Planning Engineer A. L. Elliott, and Principal Landscape Architect D. P. Van Riper.

At the time of the appointments, State Highway Engineer Womack said, "We are simply centralizing a program that has been in effect—and successfully so—for many years. In 1964 three of our freeways received national recognition in the *Parade* magazine 'scenic highway' contest. This year three state highway bridges have won blue ribbons and two others won merit awards in similar competition."

Winners in the *Parade* magazine contest are chosen for their success in a "marriage of the designs of man and nature." The bridge awards were given for cleanness and simplicity of design, plus the success of the designer in fitting them into their environment.

Starting in January this year, the division instigated a new training program in aesthetics for all levels of employees. Top-level engineers participated in six-hour workshop sessions, and beginning in February this program is being extended to the 11 highway districts, with special emphasis on the application of aesthetics to problems of design, right-of-way construction and maintenance.

In November 1965, the name of the Headquarters Roadside Development Department was changed to Headquarters Landscape Architecture Department. The change in name was made as more indicative of the various functions of the department, since roadside development is but one part of its responsibilities. The unit continues as a part of the Planning Department of Headquarters.

James Gordon, senior landscape architect, has transferred from the District 7 office in Los Angeles to the District 4 office in San Francisco, to head up a reorganized landscaping section there. He will also have additional duties as chairman of the District 4 Aesthetics Committee. Replacing Gordon in charge of the Los Angeles unit is Richard Paine, promoted to senior landscape architect from his position with the Division of Beaches and Parks in Goleta.

Since the Legislature made the scenic highway system into law in 1963, this program also has taken long strides forward. There is now a Citizens Advisory Committee composed of specialists in design and aesthetics, and also an Interdepartmental Coordinating Committee of qualified individuals of the various agencies involved.

Early in January the Department of Public Work's *Guide for the Designation of an Official Scenic Highway* came off the press, and was immediately mailed to all local governing bodies in the state. The booklet, which spells out the minimum standards to be met for a scenic highway, goes into considerable detail on what must be expected from such a highway.

One of the introductory paragraphs of the new book covers the subject of responsibilities. In clarifying this point,

it quotes from the scenic highways portion of the Streets and Highways Code as follows: "The department [of Public Works] shall take into consideration the concept of the 'complete highway' which is a highway which incorporates not only safety, utility and economy but also beauty. The department shall also take into consideration in establishing such standards that, in a 'complete highway,' pleasing appearance is a consideration in the planning and design process. In the development of official scenic highways, the department shall give special attention both to the impact of the highway on the landscape and to the highway's visual appearance."

This section also says that "The standards . . . shall . . . require that local government agencies have taken such action as may be necessary to protect the scenic appearance of the corridor, the band of land generally adjacent to the highway right-of-way, including, but not limited to, (1) regulation of land use and intensity (density) of development; (2) detailed land and site planning; (3) control of outdoor advertising; (4) careful attention to and control of earth moving and landscaping; and (5) the design and appearance of structures and equipment."

Typical of the chapter on "Criteria for Delineating the Scenic Corridor" is paragraph 3.3.3—Ecology. It says "An ecological unit is often destroyed when parts of it are encroached upon or damaged. The integrity of such unit, and the flora and fauna constituting its scenic value, should be preserved by including all of it in the corridor wherever feasible, regardless of the visibility factor."

There has also been activity in the highway districts. In San Diego District 11 was recipient of an award from the city's Downtown Association, for "Improvement and Beautification of Downtown San Diego." The citation was given in recognition of outstanding leadership, property improvement and beautification through the design and landscaping of the Interstate 5 and US 395 freeways in San Diego.

District 7, Los Angeles, has advanced the cause of highway beautification through joint programs with communities and girl scout troops. The attendant newspaper publicity featuring the tree-planting program has been excellent. (See photo herewith.)

On November 10 a teletype went out to all highway districts to report junkyards needing screening, so a priority program could be set up for this work. Although only about $100,000 of federal and state matching funds will be available for this work in the fiscal year 1966, a number of projects are already in the planning stage.

In December the Highway Commission acted on a federal grant of $5,214,000 for restoring, preserving or enhancing the scenic beauty of California state highways.

"Every project is a brand new one that for lack of funds could not possibly be included in the California Division of Highways budget just approved in October," Robert B. Bradford, Transportation Agency head, declared.

"When the Congress approved the distribution of these funds to the 50 states, there was considerable speculation that some states might simply divert them to projects that could be financed from other sources. That won't be true in California, for every cent of our share is pledged to improvements that we know our citizens want, need and deserve but for which no funds were available."

Unlike the junkyard screening funds, the money for these projects is a direct grant without any matching state funds being required. It is California's share of $60 million apportioned to the states as a part of the federal Highway Beautification Act of 1965 that was signed into law by President Lyndon B. Johnson in October.

State Highway Engineer J. C. Womack identified 31 locations where safety roadside rests will be built and five others where rights-of-way will be purchased so that similar construction can take place when more funds are available. Womack also identified 10 highway locations where vista points will be located and 27 others where landscaping projects will be accomplished.

The right-of-way purchases will require only $291,800 and the remainder will be devoted to development.

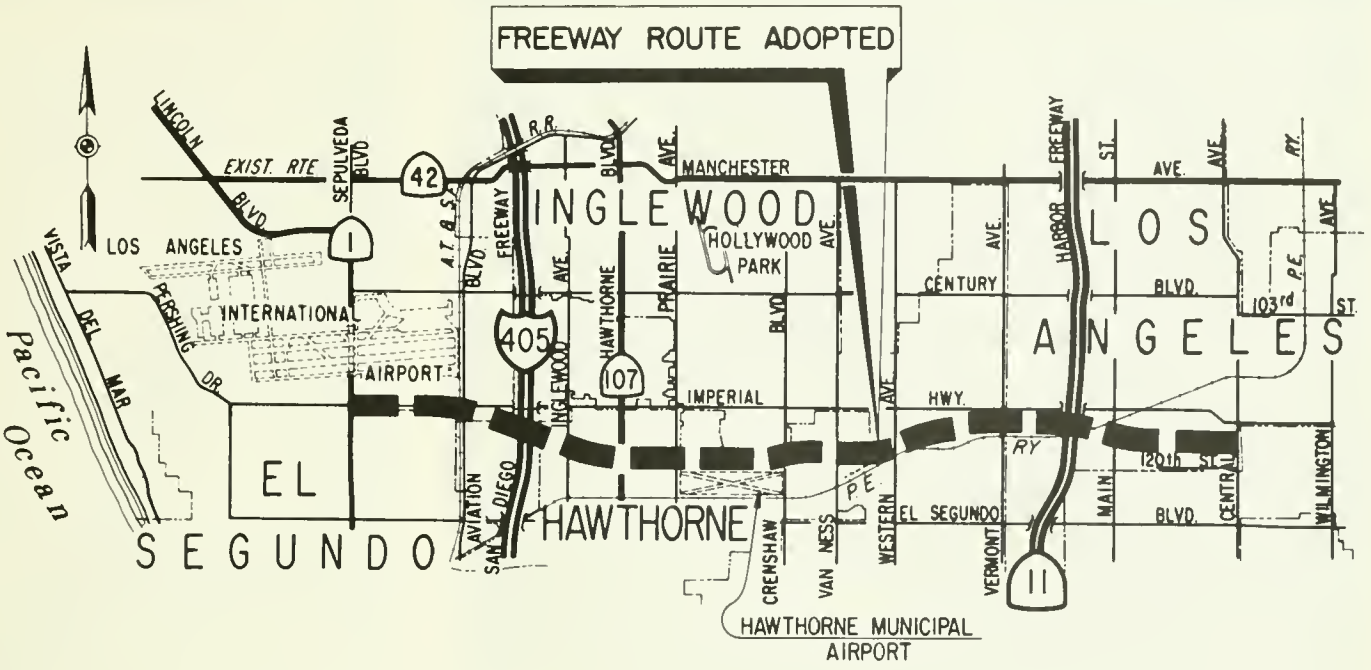
The locations of construction projects are listed on the following page.

Los Angeles area Girl Scouts planting pines on the cut slopes of the San Diego Freeway in joint operation between Los Angeles Beautiful group, Western Federal Savings, Richfield Oil, and Division of Highways. In December girls returned and planted 200 Aleppo pines furnished by Los Angeles County.

Mr. O. Henry, Jr., of Western Federal Savings and Loan Association, Panorama City, poses for picture with Los Angeles area Girl Scouts Judy and Janet McKinley. Tree in photo is one of 1,500 eucalyptus donated by Henry's company, and planted by 200 Girl Scouts during National Highway Week to beautify state freeways in Santa Monica Mountains.

BEAUTIFICATION PROJECTS

County	Route	Description	Approximate mileage	Estimated cost
Del Norte	199	At Collier Tunnel; grading to improve view	0.7	$15,000
Humboldt	36	At Devils Elbow, approximately 7.7 miles west of Bridgeville; vista point	..	6,500
Humboldt	101	About 8.5 miles south of Myers Flat; safety roadside rest	..	75,000
Humboldt	101	1.7 miles south of Fortuna to Elk River; functional and tree planting	15.7	22,500
Humboldt	101	Mad River, approximately 0.3 mile north of Arcata to 0.2 mile north of Little River; functional and tree planting	8.0	10,000
Humboldt	101	At McKinleyville Vista Point; 4.1 to 4.3 miles north of Route 200; convert to safety roadside rest (lighting, picnic tables, comfort facilities)	..	40,000
Mendocino	101	6.0 miles north of Hopland to 0.5 mile east of Forsythe Creek; functional and tree planting	14.5	50,000
Mendocino	101	At Moss Cove, approximately 10.5 miles south of Laytonville; safety roadside rest	..	119,000
Mendocino	101	At Irvine Lodge, approximately 7.9 miles south of Laytonville; safety roadside rest	..	54,000
Mendocino	101	At Empire Camp, approximately 2.6 miles south of Cummings Post Office; safety roadside rest	..	100,000
Lassen	139	At south end of Eagle Lake; vista point	..	15,000
Lassen	395	7.7 miles north of Milford; safety roadside rest	..	42,000
Modoc	299	7.0 miles northeast of Adin; safety roadside rest	..	45,500
Plumas	70	1.5 miles west of Route 89 near Keddie; safety roadside rest	..	37,000
Plumas	70	7.0 miles east of Quincy; safety roadside rest	..	46,700
Shasta	44	3.0 miles east of Shingletown; safety roadside rest	..	46,500
Shasta	44	Approximately 5.0 miles north of Route 89 near Lassen National Park; vista point	..	17,000
Shasta	299	3.5 miles east of Montgomery Creek; safety roadside rest	..	42,000
Shasta	299	Approximately 4.0 miles west of Burney; vista point	..	16,000
Shasta	299	Approximately 1.5 miles west of Fall River Mills; vista point	..	17,500
Siskiyou	97	Approximately 19 miles north of Weed; vista point	..	19,500
Siskiyou	97	21.8 miles north of Weed; safety roadside rest	..	41,000
Trinity	299	3.5 miles east of Weaverville; safety roadside rest	..	32,000
Butte	70	0.1 mile east of West Branch Bridge; safety roadside rest	..	35,000
El Dorado	50	Snowshoe Thompson Memorial Overlook at Echo Summit; vista point	..	30,000
El Dorado	89	Above Christmas Valley on Luther Pass; vista point	..	10,000
Nevada	20	Alpha-Omega Monument, 4.1 miles east of Washington Junction; safety roadside rest	..	27,000
Sacramento	99	At Grant Line Road Interchange; 2 safety roadside rests	..	130,000
Sierra	49	Depot Hill near the Yuba County Line; safety roadside rest	..	17,000
Alameda	17	South of Route 262 to north city limits of Fremont; functional and tree planting	8.6	45,000
Contra Costa	4	East of L Street to H Street in Antioch; landscape	0.2	22,000
Contra Costa	242	North of junction of Routes 680/242 Interchange to Olivera Road in Concord; landscape	2.6	236,000
Marin	131	Blackfield Drive to 0.7 mile west of San Rafael Avenue in Tiburon; landscape, functional and tree planting	1.4	15,000
San Mateo	101	Marsh Road Interchange in Menlo Park; functional and tree planting	..	25,000
San Mateo	114	Cypress Avenue to Route 101; landscape	1.1	25,000
Santa Cruz	35	At junction of Routes 35 and 9; safety roadside rest	..	30,000
Monterey	1	1.3 miles north of Vicente Creek; vista point	..	15,000
Monterey	101	2.5 miles north of Camp Roberts Overcrossing; safety roadside rest	..	75,000
San Benito	25	At Willow Creek, approximately 7.0 miles north of Route 146; safety roadside rest	..	25,000
San Benito	156	Route 101 to west city limits of San Juan Bautista; tree planting	2.4	5,000
San Luis Obispo	1	1.2 miles south to 1.2 miles north of Cayucos; functional and tree planting	2.4	10,000
San Luis Obispo	46	At Cholame Valley Road near Cholame; safety roadside rest	..	70,000
San Luis Obispo	58	0.7 mile west of San Juan Creek; safety roadside rest	..	35,000
San Luis Obispo	101	At Santa Barbara Road Overcrossing, Santa Rosa Road Overcrossing and Curbaril Avenue Overcrossing; tree planting	3.1	5,000
Santa Barbara	101	0.6 mile south to 0.8 mile north of Gaviota Tunnel; 2 safety roadside rests	..	164,000
Santa Barbara	154	0.5 mile north of Cold Spring Canyon Bridge; vista point	..	30,000
Kern	99	1.0 mile north of Herring Road to 0.2 mile south of Planz Road; functional and tree planting	11.1	90,000
Kern	99	Perkins Avenue in McFarland to 0.5 mile south of Woollomes Road; functional planting	4.0	25,000
Tulare	99	Kern County Line to Tulare Airport; functional planting	25.9	160,000
Tulare	99	0.5 mile south and 0.4 mile north of Kings River; 2 safety roadside rests	..	163,000
Los Angeles	7	Long Beach Freeway—Pacific Coast Highway to Willow Street; landscape	1.1	160,000
Los Angeles	7	Long Beach Freeway—Willow Street to Wardlow Road; landscape	1.2	135,000
Los Angeles	11	Harbor Freeway—190th Street to 0.2 mile south of 149th Street; landscape	2.2	260,000
Orange	22	Garden Grove Freeway—Trask Avenue to Manchester Avenue; landscape	2.0	220,000
Riverside	60	Santa Ana River to 8th Street Interchange (portions); landscape	2.6	267,000
Riverside	60	South junction of Routes 60/395 to Pennsylvania Avenue; tree planting	3.3	5,000
Riverside	91	East city limits of Corona to east end of Magnolia Avenue Interchange; tree planting	4.3	6,500
Inyo	395	At Haiwee; safety roadside rest	..	15,000
Kern	14	At Red Rock Canyon; safety roadside rest	..	80,000
Mono	395	North of Casa Diablo; safety roadside rest	..	60,000
Merced	152	Santa Clara County Line to Route 207; tree planting	15.0	25,000
San Joaquin	99	Calaveras River to Armstrong Road; functional and tree planting	7.2	200,000
Solano	21	Route 680 in Benicia to Route 80 near Cordelia; functional and tree planting	13.1	225,000
San Diego	94	22nd Street to west limits of F.A.I. 805 in San Diego; landscape, functional and tree planting	2.3	240,000
San Diego	94	East limits of F.A.I. 805 Interchange to west limits of Route 125 Interchange in San Diego and Lemon Grove; landscape, functional and tree planting	5.7	595,000



Highlights of CHC Actions, Sept.–Dec.

In addition to budgeting more than $739,000,000 for highway purposes in the 1966–67 fiscal year, plus more than $157,000,000 for functions not under state highway jurisdiction, the California Highway Commission made several important decisions involving freeway routings during the last quarter of 1965.

Two freeway route adoptions in Los Angeles County followed community controversies that required public hearings by the Highway Commission itself, after earlier hearings conducted by the Division of Highways.

The firsr concerned a routing for 8.4 miles of the Route 42 (Century) Freeway, extending from Sepulveda Boulevard (Route 1) at Imperial Highway, near the southeast corner of the Los Angeles International Airport, to Central Avenue in Los Angeles (see map).

The second concerned a 9.3-mile adoption of the Route 2 (Beverly Hills) Freeway from the San Diego Freeway (Interstate 405) through Beverly Hills to Ardmore Avenue in Los Angeles.

The commission also adopted a routing for 8.2 miles of the Interstate 80 Freeway in Sacramento between C Street and the future Route 244 Freeway at existing Route 80 near Watt Avenue. Although the existing route between these limits is constructed to freeway standards, State Highway Engineer J. C. Womack had told the commission that it was not feasible to widen it to the number of lanes that will be required by future traffic.

Because of problems arising from the planning of the City of Fremont's proposed civic center-recreational complex, the commission had authorized the Division of Highways to explore possible alternate routings jointly with the city for the southerly portion of a freeway routing adopted in 1961.

These studies led to the commission revising the routing of a 3.6-mile section of the future Route 238 Freeway between the future Interstate 680 Freeway and Peralta Boulevard (Route 84.)

In other actions, the commission reaffirmed its routings for the Route 1 (Pacific Coast) Freeway through Huntington Beach and Newport Beach; the Interstate 280 (Junipero Serra) Freeway near the Upper Crystal Springs Reservoir in San Mateo County; and the Route 7 (Long Beach Extension) Freeway in Pasadena. Various local governments had urged revising these routings.

The Highway Commission adopts routings for conventional highways as well as freeways. Two such adoptions of considerable interest made in the year's last quarter were a 47-mile routing to extend Route 190 in Tulare County from its present terminus at Quaking Aspen Meadow to Haiwee Pass at the Tulare-Inyo County line, and a 12.7-mile routing for Highway 267 in its entirety between the Interstate 80 Freeway near Truckee, Nevada County, and Route 28 near Kings Beach, Placer County.

The latter route was added to the state highway system by the 1965 Legislature. Its use will result in substantial time-distance savings to motorists traveling to Lake Tahoe's north shore.

At its November meeting, the commission adopted a resolution which directed the Division of Highways to undertake further studies of possible freeway alignments in the Prairie Creek area of Humboldt County, and that would skirt the boundaries of Jedediah Smith State Park in Del Norte County. Both parks contain some of California's prime redwoods.

The commission had earlier resolved to call for practical cooperation between itself, the Depatrment of Public Works and the California Division of Highways with various federal agencies and the California Legislature implementing the federal highway beautification program.

A night view of a pedestrian overcrossing lighted by one of the new fluorescent fixtures.

New Lighting For Pedestrian Overcrossing

By T. N. Kreiberg

The lighting of pedestrian crossings over freeways has usually been limited to installing a few incandescent or mercury vapor lamps on 20-foot standards spaced along the top of the structures. These, with their conduit and embedded pull boxes, are no longer in harmony with the precast, prestressed superstructure design employed today. Since the basic lines of the pedestrian overcrossings are horizontal, vertical standards detract from the basic horizontal silhouette.

An essential part of the pedestrian overcrossings is the chain link sidewalk railing. The top rail on this chain link railing can be used for installing fluorescent lighting.

Development

Such a lighting system involves the same problems which were successfully solved in the design of the undercrossing or tunnel fixtures now used extensively in pedestrian tunnels under freeways throughout the state, namely: resistance to vandalism; adequate light distribution; provision for heat dissipation; and easy accessibility for relamping and other maintenance. These problems suggested the use of the fluorescent lamp and plastic lens that had been adapted for the undercrossing fixtures. A four-foot lamp was developed with a ½-inch-wide slit in the phosphor coating along the full length of the glass tube. The lamp operates at a current of 1½ amperes. (This is three to five times the current in the ordinary fluorescent lamp.) Lenses of clear methyl-methacrylate plastic resin castings are mounted parallel to the lamp. This lens system was adapted to fit a protruding aluminum housing of two parts 6 feet 4 inches long and less than 5 inches in width. The fixture can be positioned to concentrate light on any portion of the walkway.

Two such fixtures were produced as the result of a Bureau of Public Roads participating research project. These fixtures were tested in the Materials and Research Department of the Division of Highways. The tests included plotting isolux curves for a variety of plastic lens shapes, measuring temperatures developed in the fixtures, and checking the ability of the fixture to withstand bad weather.

Some improvements were also made in the components of the fixture, including development of a cast methyl-methacrylate resin lens to replace the machined acrylic rods originally used.

Evaluation

The cast acrylic lens afforded an opportunity to experiment with various lens shapes. Three different shapes of hollow lenses were produced and tested in addition to the solid flat lens and solid concave lens. The usable portion of the light is normally considered to be the central 10 feet of the pattern indicated by the unshaded portion of each isolux curve. Ideally, the pattern should extend as far as possible parallel to the fixture. There was not much difference in the shapes produced by the lenses, as far as the light in the usuable portion was concerned. The isolux curve of the hollow concave lens appeared to extend slightly farther and consequently is being used for the time being. It may be possible to improve the lengthwise distribution of light by

A new fluorescent luminaire unit in a chain link sidewalk railing.

A pedestrian overcrossing with the old-style luminaires mounted on 20-foot standards.

The Tweedy Lane pedestrian overcrossing in Los Angeles with the new-style fluorescent luminaires in the chain link sidewalk railing.

further experimenting although preliminary trials with additional prisms in the lenses have not been encouraging.

Tests also showed that an aperture lamp gives twice as much light underneath the fixture as a very high output (VHO) lamp and over twice as much light at a 10-foot distance endwise from the centerline of the fixture.

The water tests included spraying a stream of water from a garden hose nozzle at the fixture at an angle to simulate a wind-driven rain. Some moisture did penetrate the fixture by capillary action through the hinge connection. However, lubrication of the hinge with silicon grease eliminated the leak.

Fixtures will be aimed to direct the center of the light pattern along the centerline of the structure walkway. This would normally tilt the fixture about 15 degrees from the vertical, causing any moisture to collect on the inner surface nearest the hinge and drain from the end of the door. Fixture wiring from the ballast to the lamps will be clipped to the door on the opposite side of the lamp in order to keep it out of this moisture.

Study of the isolux curves suggests that enough light can be provided with spacing the units 40 feet apart. The light pattern on the walkway is not completely uniform but will be adequate.

Conclusion

The unique feature of this lighting method is the combining of the lighting components and the fence members as one unit in which the top rail not only supports the fixture and houses the circuit conductors but is a structural part of the fence, presenting a neat appearance and simplicity of design.

The fixtures developed as a result of this project are being installed on most pedestrian overcrossings on state highways. The first such installation was the Tweedy Lane pedestrian overcrossing on the Santa Ana Freeway in Los Angeles County which was completed in April 1965. The manufacturer of the fixtures estimates that they can be produced at a cost of under $250 each.

A condulet fitting (upper left) on the end post of the chain link railing on a pedestrian overcrossing.

Langsner Receives A.S.C.E. Award

George Langsner (right), Deputy State Highway Engineer, receives a certificate of appreciation from Wayne MacRostie, president of Sacramento section of the American Society of Civil Engineers, for completing a term of office as chairman of the Highway Technical Division of the national society.

Earl W. Taylor Ends 42-Year Career

District 6 Traffic Engineer Earle W. Taylor retired November 30 ending a 42-year career with Highways.

Taylor was among the first district traffic engineers in the division, being appointed in 1938. From his Fresno-based headquarters, he pioneered numerous improvements in highway design and signing which have had statewide impact in traffic safety. Through his close association with city and county engineers in the southern San Joaquin Valley, he became known as an "experts' expert" in the traffic engineering field.

He organized the first district safety committee in the state and served as a member and its chairman for many years. Upon his retirement he was presented with a certificate of merit citing his 42 years' lost-time-free accident record.

Taylor's first job with Highways was in District 4 working on the Pacheco Pass Road. Later he worked in Districts 1, 3, 5, 7, and 9 before going to District 6 in 1934. During his early career he held engineering jobs with the Oregon Highway Commission, the City of San Francisco, P.G. & E., and the City of Santa Barbara. For 2½ years during World War II, he was highway branch chief of the U.S. Army Transportation Corps covering the six New England states. He retired from the Army Reserve in 1955 as a lieutenant colonel.

He was born in Pullman, Washington, and attended schools there and in Salem, Oregon. He later attended the University of California.

He is a member of the Institute of Traffic Engineers and the Engineers Club of Fresno.

Taylor and his wife, Norma, have two sons, Bob and Bill. Bill is an associate right-of-way agent for the division.

Richard S. Quintrell Retires in Eureka

Richard Samuel Quintrell, assistant highway mechanic foreman at Shop 1, Eureka, has retired from state service.

Quintrell started working for the Division of Highways in June 1938 at Shop 2 in Redding as a heavy equipment mechanic. He later worked at Shops 7 and 9, served in the Army during World War II, and then came to Shop 1 in Eureka in 1945.

Twenty-five-year Awards Announced

The following Division of Highways employees have received their 25-year awards since the last list was published in the November–December 1965 issue of the magazine:

Lloyd A. Lane, Luis Aramayo, Marion W. McCleary, Charles K. Bruner, William Travis, William D. Rambo, Everett P. Pyles, Omar G. Alexander, John H. Bennett, Abe Brodkin, Seymour Cowan, Leo Linde, Arthur E. Bethurum, Bliss A. Hinshaw, Charles L. Sexauer, Dudley B. Hatch, Homer H. Moore, Mary Catherine Malloy, Herbert A. Rooney, Thomas C. Royce, Dale F. Downing, Oliver Arnold, O. W. Perry.

STATE OF CALIFORNIA

EDMUND G. BROWN, *Governor*

TRANSPORTATION AGENCY

ROBERT B. BRADFORD . . . Administrator

DEPARTMENT OF PUBLIC WORKS . . . JOHN ERRECA, Director

FRANK A. CHAMBERS . . . . Chief Deputy Director

USSELL J. COONEY . . Deputy Director (Management)
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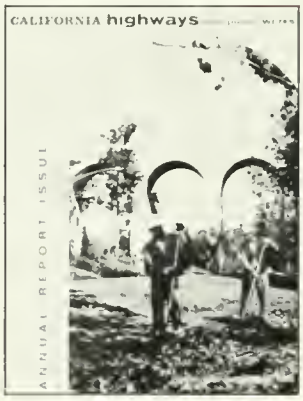
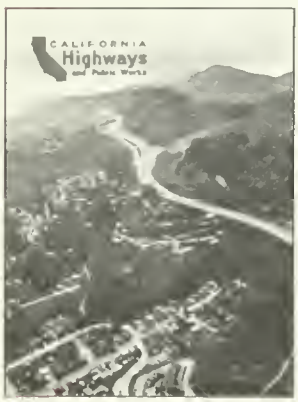
March - April 1966





The yearly index will no longer be printed as part of the magazine but on separate pages punched so that they can be inserted into a three-ring binder. Readers who want copies of the index covering the issues for 1965 should send their requests to the editor.

CALIFORNIA
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OFFICIAL JOURNAL OF THE DIVISION OF HIGHWAYS, DEPARTMENT OF PUBLIC WORKS, STATE OF CALIFORNIA

VOLUME 45 MARCH-APRIL NOS. 3-4

HIGHWAY BEAUTIFICATION 2
By J. C. Womack

INTERSTATE 80, A CHAMP 8

STUDENT ARCHEOLOGISTS GLEAN HIGHWAY SITE 9

MACARTHUR FREEWAY 12
By Dale C. Ryman

DEAN CREEK TO MIRANDA 16
By H. W. Benedict

SIERRA CROSSING 20

A NEW MARK FOR SAFETY 26

CALIFORNIA NUMBER ONE 28

AWARDS PRESENTATION 33

INTERSTATE 5 FREEWAY—DISTRICT SIX 36
By George Fluter

INTERSTATE 5 FREEWAY—DISTRICT TEN 38
By George B. Avery and Kenneth Wells

SUBSIDENCE AND THE WESTSIDE FREEWAY 40
By William F. Kleiman

COMPACTION CONTROL WITH NUCLEAR GAGES 42
By William G. Weber, Jr.

TRUCKEE–BROCKWAY SHORTCUT 43

INSTANT FREEWAYS 44
By Paul Brown

THE UKIAH FREEWAY 46
By L. B. Dwyer

BYLINES 48

"An outstanding network of state highways is essential to the future growth of California's economy"
—*Governor Edmund G. Brown*

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FRONT COVER: California is No. 1! Section of Route 88 near Carson Pass summit wins PARADE Magazine annual contest for best designed highway project completed in 1965. (See page 28.) In the words of Ed Kiester, PARADE's Managing Editor, ". . . the PARADE Scenic Highway Award annually designates the new highway which best embodies the principles of good design, beauty, and utility." (Jack Meyerpeter, photographer)

BACK COVER: Evening in Los Angeles. Looking northeast toward Civic Center across Third Street overcrossing of Harbor Freeway. Building on left is Department of Water and Power, building on right is the Music Center. (Sam Smith, photographer)

HIGHWAY BEAUTIFICATION

By J. C. Womack, State Highway Engineer

The preservation and enhancement of scenic features along the highways of our state and our nation have in recent years become subjects of intense interest. With our expanding population enlarging the urban areas, there is greater need to conserve open space and natural beauty.

When we speak of the general term "highway beautification," just what are we really talking about?

The beautification program is, to quote a phrase, "a many-splendored thing" that includes both constructive and control considerations. On the constructive side, we have the many factors that become a part of the highway plan or design, such as special location considerations to provide appropriate viewing of scenic features; locations which blend the roadway into the area to minimize scarring of the landscape; special design techniques for bridges and other structures; provisions for restoring native plant growth; provisions, especially in our urban areas, to beautify by appropriate landscaping and screen-type planting; and provisions for roadside rests, vista points, and other facilities to meet the needs and provide comfort for the traveling public.

In our highway beautification program, too, we must consider not only the motoring public but also those who live and work near the highway. Appropriate screen planting and other beautification efforts can greatly enhance the surroundings of these state highway system neighbors.

On the control side, provisions are necessary for restricting and, in many cases, eliminating junkyards and billboard displays that mar the view of the motoring public.

The problem of highway location and design today is a search for the ideal solution to meet the requirements of traffic service, safety, economics, local area benefits, and the preservation and enhancement of scenic and historic values.

The highest human value is life itself, and our greatest challenge is to reduce the toll of deaths and injuries associated with automobile accidents. The fact that this year probably 50,000 persons will lose their lives as a result of automobile accidents in this country demands that we build maximum safety into our highways.

Very often in discussing roadway construction through scenic areas, people discuss capacity and safety aspects of geometric design as separate and distinct from aesthetic considerations. This, we believe, is an erroneous approach. Aesthetic considerations must include all factors which influence the emotions.

1

2

3

1. Vista Point on Redwood Highway along Pacific near Arcata. 2. Vista Point on US 101 just north of Golden Gate Bridge. 3. Golden State Freeway, Los Angeles. 4. Redwood Creek Bridge on US 299, Humboldt County. This replacement bridge after the floods of 1964 is now open to traffic.

4

ecurity and an Absence of Irritation . . .

A sense of relative security and an absence of irritation must exist if the scenic features of the area are to be appreciated. By irritations, it is meant such factors as severe and changing curvatures, narrow roadway width, apprehension regarding traffic attempting to pass and creating unpredictable safety conditions, and bumper-to-bumper traffic. It is our belief that the roadway should be designed to accommodate the traveler in a relaxed manner at an appropriate speed.

An important factor in any plan to preserve scenic features is to control the access along the highway. Access control was initiated as a means of preserving the effectiveness of the roadway by limiting the points of entry and exit and thereby preventing future congestion created by traffic movement to and from adjacent properties. This access control feature, however, also has a very desirable byproduct in that commercial and other development is minimized along the area immediately adjacent to the highway. Generally accepted standards for scenic highways and parkway development have specified this access control feature. In this regard, recently enacted legislation in California relative to a possible future parkway system also stresses this access control feature as a necessary means of preserving the scenic areas adjacent to such parkway development.

The topic of roadside beautification is not new to the Division of Highways. Efforts along these lines extend back half a century or more, although funds have traditionally been a problem as the state struggled to keep abreast of ever-increasing highway traffic service demands.

During the 1950's, added emphasis was placed upon highway beautification, and more extensive landscape projects were undertaken, especially on freeways through urban areas. The results can be seen in the lush growth along many of our established freeways.

In 1957, the Legislature adopted Assembly Concurrent Resolution No. 132 pointing out that expenditures for landscaping and design that enhance the attractiveness of highways are legitimate highway development purposes for which the traveling public may be expected to pay. The resolution further stated that it was the intent of the Legislature that the landscaping program be moderately increased and all aspects of attractive design appropriate to conditions in this state be regarded as integral features of the California freeway program.

In the evolution of California's roadside policy, three types of planting have been developed—functional planting, landscaping, and tree planting. In general, functional planting, as its name implies, is basically for utilitarian purposes with, of course, aesthetic side effect benefits. One example of functional planting is the use of oleanders in the median of many divided highways to screen oncoming headlights. Landscaping goes beyond pure function and is specifically directed toward aesthetic appeal. Tree planting is for the primary purpose of aesthetic improvement in undeveloped areas where a higher type planting is not justified, and also, in some cases, to provide natural appearance by replacement of trees removed for roadway construction.

From the beginning of highway beautification efforts through the current 1965–66 fiscal year, the installation of all classifications of planting (landscaping, functional and tree planting) has amounted in original dollar value to approximately $45,000,000. These projects have required an almost equal amount of funds for maintenance. Funds provided for the coming 1966–67 budget ($9,500,000 for planting, $7,700,000 for maintenance) will boost the total expenditure for roadside planting and maintenance to well over $100,000,000. Future fiscal programming calls for ever increasing annual amounts for highway beautification purposes. The professional landscaping staff of the Division of Highways has been expended through the years and is now a separate major department within the Division of Highways.

Highway aesthetics or beautification is, however, far more encompassing than landscaping. While landscaping and the restoration of native vegetation can provide the finishing touch, our total program approach stresses such factors as appropriate route corridor selection, contour grading, the blending of the roadway into the terrain, scenic vistas afforded the motoring public, and a multitude of other vital factors.

To further these objectives, the Division of Highways has established centralized control of aesthetic considerations in all phases of its work by the creation of a special Committee on Aesthetics and Highway Beautification. This committee is developing requirements for aesthetic treatment in the various phases of highway work and is conducting aesthetic training throughout all offices of the division. The training is aimed toward the continuing awareness of aesthetics among all personnel engaged in highway planning and design activities.

Greatly accelerated emphasis is being given to the topic of highway beautification by recently enacted federal legislation. The federal program made possible through enactment of the Highway Beautification Act of 1965 provides for the control of outdoor advertising and junkyards along specified federal-aid highways. Additional funds will also be available for landscaping and other scenic enhancement projects on these routes. In terms of roadway mileage, this means that the 2,166 miles of interstate highways and over 7,000 miles of primary (U.S. highway designations) routes within California

will be eligible for additional highway funds specifically for highway beautification. The act provides both an incentive for beautification in the way of additional funds for that purpose and also penalties in reduced roadway development funds for those states that do not undertake billboard and junkyard control programs.

States are required to control outdoor advertising signs, displays, and devices which are, with certain exceptions, within 660 feet of the highway right-of-way and visible from the main traveled roadway.

Certain areas will be specified on interstate highway routes where signs of particular interest to the traveling public may be erected and maintained. Standards will be established as to the type and size of such signs.

In regard to junkyards, the act provides for either effective screening by natural objects, fences, trees, or other appropriate means, or if this is not possible, then for removal. The distance guideline in junkyard control is 1,000 feet, contingent upon its being visible from the main traveled portion of the highway.

The billboard and junkyard control programs do not apply to areas designated for industrial use or determined to be predominantly industrial in nature. In addition, a similar exception applies to billboards in commercial zones or areas.

In the case of billboards and junkyards that are presently in existence or which come into existence before controls are established, the final deadline for removal or screening is July 1, 1970. Just compensation is to be paid the owners of billboards and junkyards thus affected, with the federal government providing 75 percent of necessary funds.

A third phase of the federal beautification program provides additional funds annually for landscaping and roadside development. This includes acquisition and improvement of strips of land (in easement or fee) necessary for the restoration, preservation, and enhancement of scenic beauty adjacent to such highways.

All of the federal government's financing for the billboard and junkyard programs and the additional money for landscaping are from general funds which are in addition to roadway funds now being received.

Another topic closely associated to the highway beautification program is a plan to designate some of our existing highway routes as scenic highways. The general plan was authorized under legislation enacted in 1963, and the program is now only in the preliminary stages. In future years it should, however, provide a very desirable means of touring the more scenic and historic areas of the state.

Prior to the enactment of the legislation establishing the scenic highway system, a series of studies and plans was developed through the coordinated efforts of a citizens advisory committee and representatives of various affected state agencies. The resulting scenic highway plan comprises approximately 6,000 miles of highways through our most beautiful natural scenery.

The law authorizing the scenic highway system included provisions for a permanent advisory committee, the members of which are appointed by the Governor. This committee, composed of persons with demonstrated interest and dedication to highway beautification and scenic enhancement, has now established standards and criteria for scenic highways.

A 72-mile-long portion of Highway 1 in Monterey County was designated on June 11, 1965, as an official California scenic highway, thereby becoming the first highway in the state to receive the official scenic highway designation.

The staff of the Division of Highways is working very closely with the advisory committee and is engaged in numerous field reviews regarding scenic highway routes. This new system should, in future years, provide a source of scenic motoring enjoyment for the people of California.

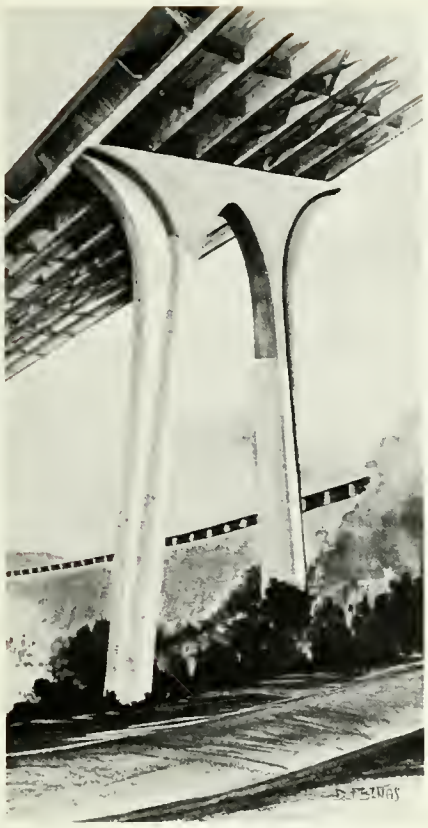
In 1963 the Legislature enacted a bill which became effective on September 20, 1963, authorizing the Division of Highways to construct a system of safety roadside rests throughout the state.

Prior to this time a very limited number of such facilities had been constructed and operated by the Division of Beaches and Parks. Fund limitations under the old program had severely restricted development of such facilities.

Under the new Division of Highways program, these roadside rest areas, in conjunction with facilities provided in communities of over 10,000 population and with existing state parks and other recreational areas, will provide an opportunity for motorists to avail themselves of some type of rest facility approximately every 30 minutes of driving time.

Master planned are 257 safety roadside rests, of which 40 are constructed or under construction and another 58 are programmed for construction in the near future. Most of these areas include toilet facilities, picnic tables, natural or constructed shade, drinking water, and park areas. Public use of and reaction to the completed facilities have been overwhelmingly favorable.

Highway Aesthetics . . . More Than Landscaping



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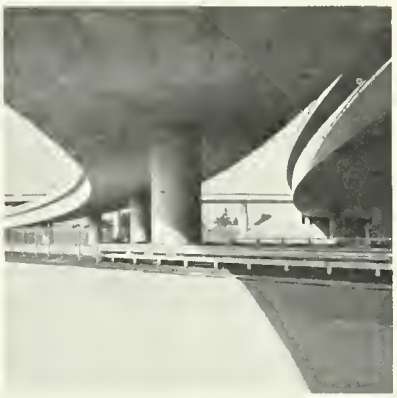

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1. Rendering of design for San Mateo Creek Bridge now under construction on Junipero Serra Freeway. 2. Structures on San Diego-Santa Monica Freeway interchange, given special award for design by Portland Cement Association. 3. Simple line of Hot Springs Creek Bridge, Monterey County, which uses prestressed concrete girder construction. 4. Architectural study for Magdalena Avenue Undercrossing, Junipero Serra Freeway.

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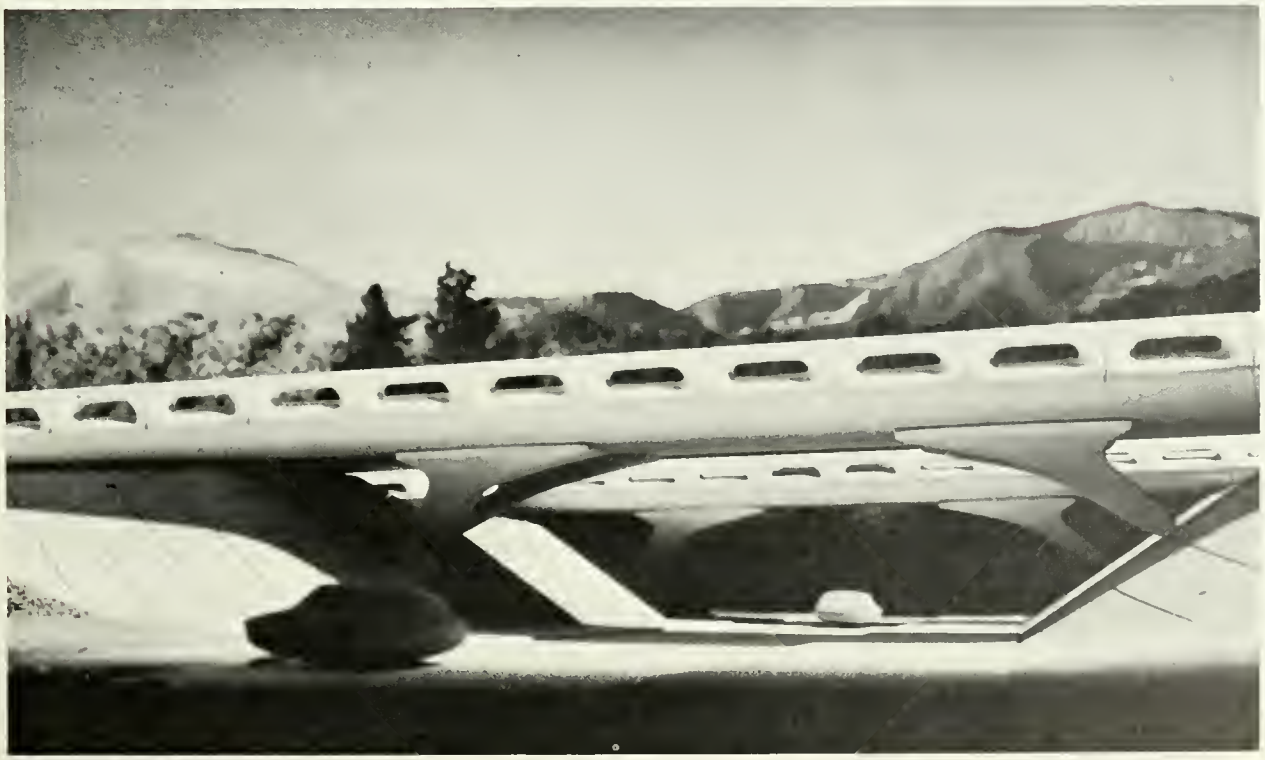

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Aerial photograph shows entire Donner Pass country. At far end of Donner Lake is place where Donner Party was trapped, and just beyond town of Truckee. New Interstate 80 route winds along slopes, upper left, and old route is seen lower center.

INTERSTATE 80 A CHAMP

one of
BEST
1965
Engineering
Achievements

Division was proud of concrete arch bridge on old US 40 when it was built in 1920's, but it is inadequate for today's traffic.

California's trans-Sierra freeway has been named one of the three most outstanding engineering achievements of 1965 by the American Society of Civil Engineers in their annual competition. The merit award was for the entire stretch of I-80 from immediately east of Sacramento to the Nevada state line, but particular emphasis is placed on the new section over the Sierra summit.

First place in the national competition was awarded to a space vehicle launching pad at Cape Kennedy. Interstate 80 and the ultrasophisticated Seattle Metro Comprehensive Sewage Program were runners-up and both will receive merit awards.

Ten years were required for the planning, design and construction of the highway. Although it is only a comparatively short 115-mile portion of the 2,920-mile intercontinental highway which connects San Francisco Bay and New Jersey's Atlantic seacoast, the new section represents a major accomplishment because of the terrain.

It spans the rugged Sierra at a seemingly modest elevation of 7,239 feet, but the winter weather is often vicious. Snowpacks are 30 feet deep some years and an annual snowfall of 65 feet is not unknown. The record is 80. At least once each winter 80-mile-an-hour winds can be counted upon to strike the summit.

Snow removal is a complicated procedure that uses a whole gamut of heavy equipment and costs $850,000. But it is worth the cost, for traffic is seldom interrupted. Such closures as are occasionally necessary are more likely to be from blizzard conditions and impaired visibility, rather than snow and ice on the pavement.

Portions of the new construction are four-lane divided freeway, but the highway separates into two roadways in the snow belt to allow space to dump snow removed from the right-of-way.

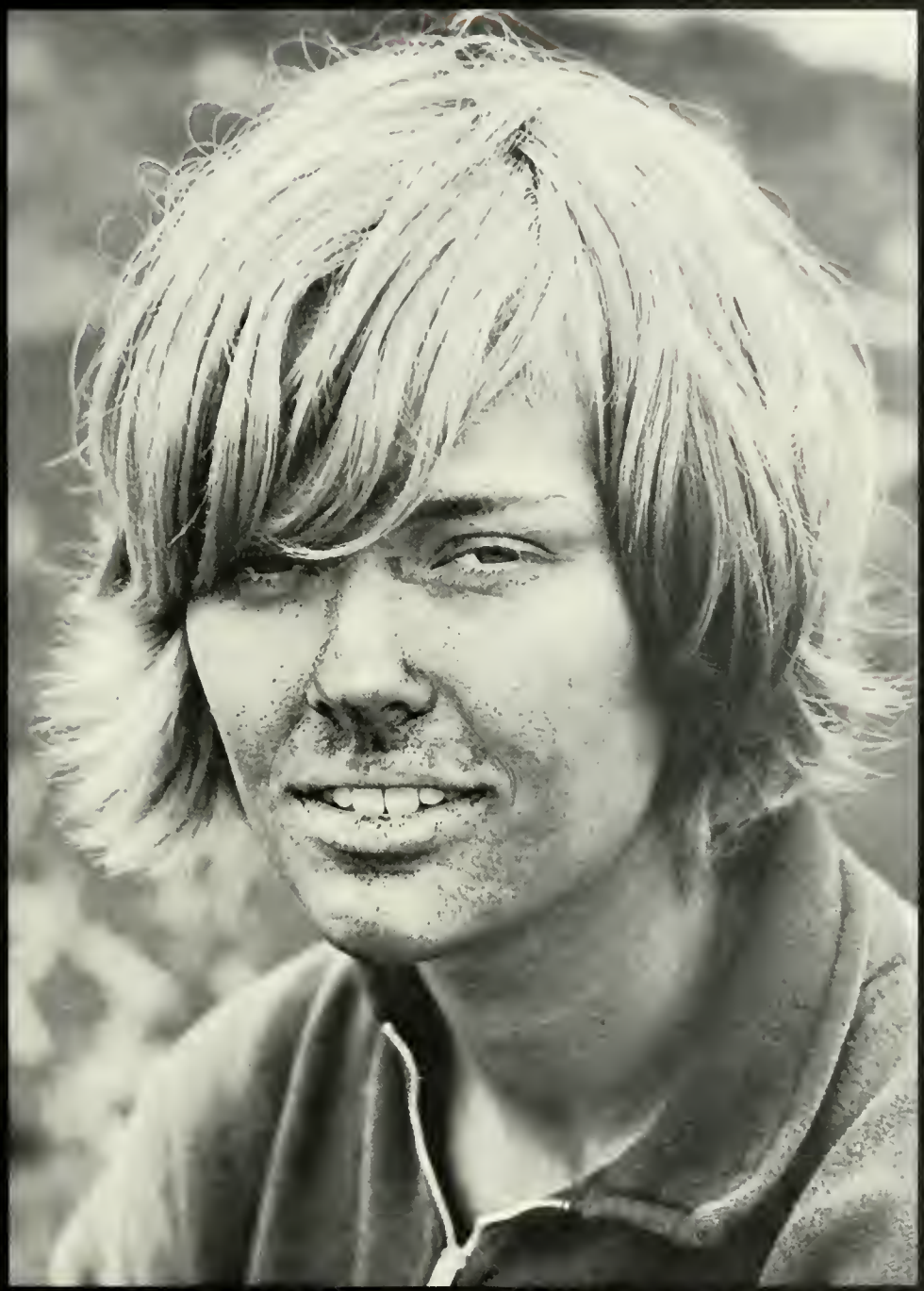
Construction was under the supervision of the California Division of Highways' District 3, headquartered at Marysville. The same unit maintains the route.

District records reveal 2,500,000 pounds of explosives was required to blast rock and other obstructions from the right-of-way across the top 10 miles of the mountain. One 22-mile section involved removal of nine million cubic yards of rock and dirt, and it took 282,000 barrels of portland cement to mix the paving.

The award-winning highway was sponsored by the Sacramento Chapter of the A.S.C.E. It is believed to be the first highway construction ever to win a national award from the A.S.C.E.

The judges cited it as "a project which demonstrates the greatest in engineering skills and represents a great contribution to civil engineering progress and mankind."

Other entries that reached the final judging were the Harris County Domed Stadium at Houston, Texas; the Northern California Flood Rehabilitation Work; the Chicago Circle Campus Development of the University of Illinois; and the hurricane barrier at New Bedford Harbor, Massachusetts.



STUDENT ARCHAEOLOGISTS GLEAN HIGHWAY SITE

Girls and boys both man business end of shavels, make dirt fly.

Test pits go down slowly; sometimes are handful at a time.

U. C. L. A. Archaeology Students Make "Dig" on Highway Right of Way

The preservation of valuable sites for paleontological or archaeological exploration and study is a joint endeavor between the State Division of Beaches and Parks and the State Division of Highways. Federal-aid highway funds are authorized as payment to site workers who are preserving artifacts of scientific value. By the nature of the cooperative agreement, these contracts are arranged for by the Beaches and Parks agency, and the Division of Highways then makes the funds available.

The happy photos on the accompanying pages were made of a group of U.C.L.A. students engaged in an archaeological "dig" on the Highway 1 right-of-way a few miles north of Cambria. It is obvious such a "dig"

Judith Uram here is cataloging material for shipment to U.C.L.A. for further study.

Photos courtesy San Luis Obispo County *Telegram-Tribune;*
JACK WILSON, photographer

can be a valuable outdoor recreational experience as well as an educational one in the lives of these young people. In addition, some more bits of scientific knowledge have been added to humanity's store, and many artifacts collected for cataloging and study by other students.

In the dig pictured, 18 of the U.C.L.A. students worked a month at two sites in the vicinity, living in big dormitory tents, with two large trailers for laboratories. They dug dozens of their neat 5-foot-by-5-foot-square holes, a six-inch layer at a time, carefully screening the dirt. When they were finished they had thousands of artifacts to take back to Los Angeles, all neatly packed in paper bags and labeled.

Students here are working in pairs—one digging in the pit, the other screening the dirt and recovering artifacts.

MAC ARTHUR FREEWAY

Relief for the Nimitz Freeway

By D. C. RYMAN

Sometime this spring, when the eighth and final unit of the MacArthur Freeway is opened to traffic, motorists will be able to enjoy 16 miles of signal-free driving between the San Francisco-Oakland Bay Bridge and Castro Valley Junction in Hayward.

Built at a cost of $100,000,000, this section of Interstate Route 580 will provide relief for the Nimitz Freeway, giving east bay motorists a faster, safer, more enjoyable route. Effect on traffic patterns became markedly noticeable last November, when the freeway was extended to San Leandro.

Right-of-way cost for this eight-lane urban facility, which included buying the property, clearing buildings and relocating utilities, was $54,000,000.

Construction costs for the eight contracts totaled $44,000,000.

Three landscape contracts have been completed, another is underway, and three others are scheduled for advertising this summer and fall.

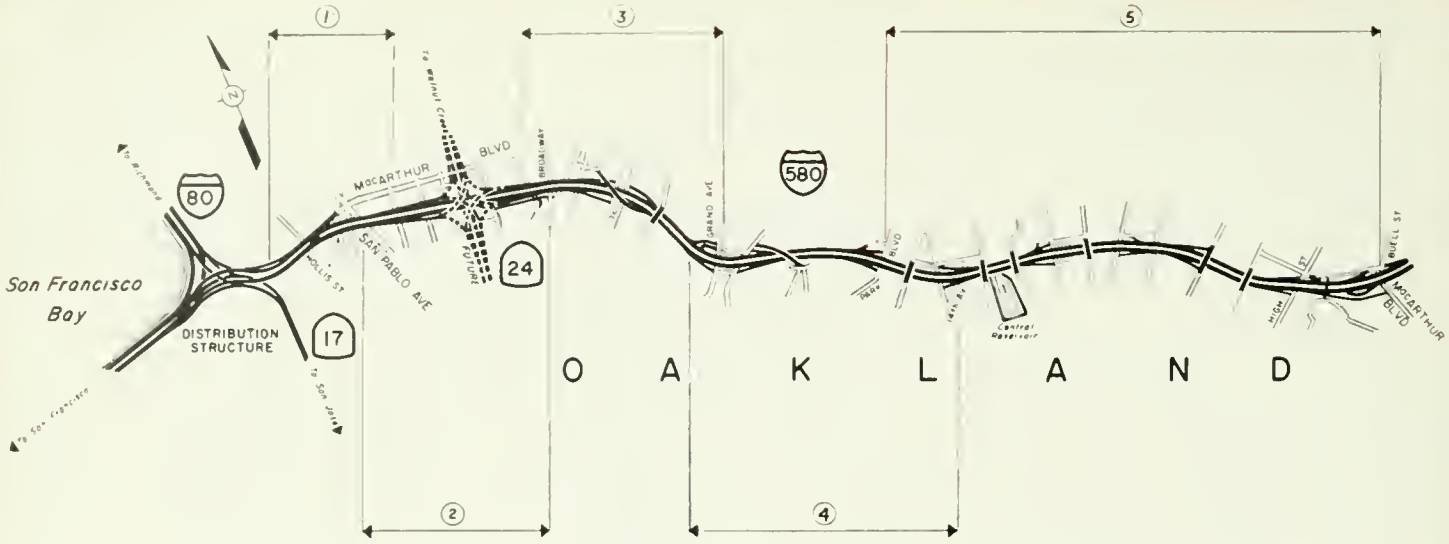
The first section of the MacArthur Freeway from the distribution structure to Park Boulevard was adopted in January 1955 and completed in December 1962.

The route was adopted from Park Boulevard to Durant Avenue in May 1957, and from Durant Avenue to 173rd Avenue the following month. The planning, design, and right-of-way of this section were written up in the March–April 1960 issue of *California Highways and Public Works.*

Construction on the first MacArthur Freeway project was started in February 1960. It traversed a fully developed area on embankment and structure to allow the local streets to cross underneath. Six retaining walls were used to save taking additional improvements.

The $2,982,000 project included additions to the distribution structure, MacArthur on- and off-ramps, the MacArthur Boulevard undercrossing, and two 1,100-foot-long parallel undercrossings at Adeline Street. It was completed in May 1962.

The second contract (completed April 1962; cost, $4,329,000) from Webster Street to Grand Avenue ran through a metropolitan area of residences, apart-



Construction Progress. Contracts one to five covered construction of the MacArthur Freeway from the distribution structure to Buell Street.

The trees and shrubs planted along the MacArthur Freeway four years ago have now matured to where they add considerably to the appearance of the surrounding right-of-way and median strip.

This aerial photo of construction on the MacArthur Freeway was taken last August. In the foreground is the interchange with Route 13, which extends through the center of the photo towards the Warren Freeway in the distance. View is northward.

ment buildings, and small businesses.

Construction of 19 retaining walls saved a lot of valuable property including a school. The job included the double 1,046-foot-long Broadway-Richmond undercrossing, four bridges in the Oakland-Harrison Street interchange, and the Chetwood Street overcrossing.

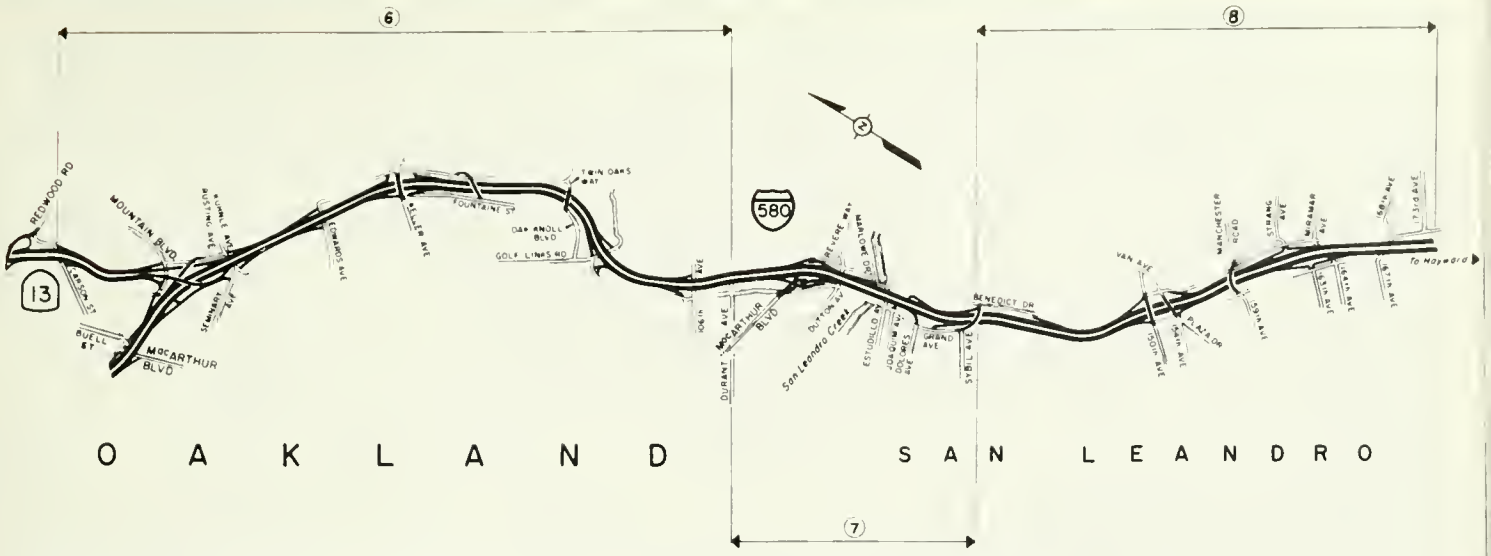
Construction began in August 1960, on the third contract, a 1.1-mile section between San Pablo Avenue and Broadway (completed January 1962; cost, $4,000,000).

This job included the foundations for the future major interchange for the MacArthur and Grove-Shafter (Route 24) Freeways. At the time coordinated planning studies were underway with the Bay Area Rapid Transit. Six years later, this cooperative planning resulted in a joint engineering design placing the rapid transit rails in the median area of the Grove-Shafter Freeway. This rail construction will start this summer.

The fourth contract (completed December 1962; cost, $4,178,000) extended the freeway past Lake Merritt and the Grand-Lakeshore area on structure and on sidehill cut-and-fill to Park Boulevard.

It includes the Lakeshore Park undercrossing, a reinforced concrete bridge with round columns, 838 feet in length, carrying freeway traffic across Grand and Lakeshore Avenues. The space under and adjacent to the bridge between the streets allowed an extension of the adjacent Lake Merritt Park area.

On the sidehill portion, a split-level grade was used for both directions of freeway traffic. This required a 3,900-foot-long median strip retaining wall. Also, an 800-foot-long wall was placed on the cut side and a 355-foot wall on the hill side. These two walls saved many adjacent improvements throughout this



Contracts six to eight continued the freeway from Buell Street to 173rd Avenue in San Leandro.

business and residential area.

(A detailed report of the first four contracts appeared in the July–August 1962 issue of *California Highways and Public Works.*)

The fifth contract (completed June 1964; cost, $7,290,000) of the MacArthur Freeway covered three miles from Park Boulevard to Buell Street through residential and small business areas.

The sixth contract (completed October 1964; cost, $4,663,000) was from Durant Avenue in Oakland to Sybil Avenue in San Leandro. Most of this two-mile section is on a graded-earth fill. Several high retaining walls constructed next to MacArthur Boulevard preserved it as a business street for the local merchants and manufacturers.

The seventh contract (completed November 1965; cost, $11,530,000) extended the freeway from near Mills College to the east city limits of Oakland and included a full directional interchange to the Warren Freeway near Calaveras Avenue.

When Governor Brown inspected the project last October, prior to its opening to traffic, he pointed out the graceful curvilinear route and noted that the new 4.5-mile freeway segment will save motorists eight minutes in comparison to the old city street route. The Governor also stated that the view from the freeway is "far better than streets lined with buildings built in 1900."

The job required three years to construct, cost $11,530,000 and was completed November 1965.

The eighth and last contract was for the three-mile section from Sybil Avenue in San Leandro to 173rd Avenue near the Castro Valley interchange and follows the general route of Foothill Boulevard (the extension of MacArthur Boulevard).

The project, when completed, will cost $5,174,000.

Coordinated planning resulted in a design placing the Rapid Transit rails in the median.

The work begins. This 1960 photo shows the cleared right-of-way through Oakland for the MacArthur Freeway leading to the distribution structure and San Francisco Bay in the background.

Dean Creek to Miranda

By H. W. Benedict

Completion was marked recently of the final unit of a 25-mile section of the Redwood Freeway in southern Humboldt County, which not only provides the motorist with a shorter, faster, safer drive but also offers an added bonus of breathtaking vistas of redwood forests, the turbulent Eel River, and rolling green hills dotted with hardwood groves. These scenes are constant reminders that modern highways can be built in a way that need not detract from the natural grandeur of the surrounding country.

The new freeway forms the completed section of a 43-mile freeway routing adopted by the California Highway Commission in 1956 from the Mendocino-Humboldt county line to Jordan Creek. It is seven miles shorter than the old highway.

Within months after adoption, construction was started on the first unit of the freeway when Guy F. Atkinson began work in early 1957 on a contract between Dyerville and Englewood. Construction of this and the next two units of the Redwood Freeway were described in the January–February 1962 issue of the *California Highways and Public Works*.

A contract to build the fourth unit of the freeway was let in May 1962 to Morrison-Knudsen Company, Inc. The 5.7-mile job was completed in October 1964 at a cost of $6,000,000.

For over four miles the fourth unit follows the west side of the river, across the canyon from the old road. Only the south end of the project is on the east side of the river where the old highway was located. The freeway has been built far enough up the canyon wall to reduce the danger of inundation by future floods.

In many areas the foot of the embankment slope is right at the river's edge, requiring the extensive use of rock slope with deep foundation trenches and other protective measures during construction. Despite the heavy cost of such protective work it is still much cheaper than locating the freeway higher up the slopes.

To stabilize embankment foundations, almost 250,000 tons of gravel and six miles of metal pipe underdrains were used.

Three bridges were included in the project. The largest, a composite steel girder structure across the South Fork of Eel River at Sylvandale, is five lanes wide to accommodate an acceleration ramp. The two others are separation structures: one at the Dimmick Road and the other part of the Maple Hills Interchange.

The Sylvandale Bridge was in the news recently when the State Legislature, in its 1965 session, dedicated it to the

This new scenic section of the Redwood Freeway along the South Fork of the Eel River in Humboldt County replaces a slow, outmoded, two-lane highway.

Northward view along recently completed fifth unit of the Redwood Freeway a few miles downstream from Garberville. Eel River, seen here at summer low, is accessible from frontage road to left of freeway.

memory of Charles R. Barnum, an early pioneer and developer of the southern Humboldt region. The bridge received additional honors when the American Institute for Steel Construction awarded it second place among all bridges of that size opened to traffic in 1964 in the United States.

The project carried through two winter seasons between 1962 and 1964. Heavy rains, coupled with the notoriously unstable soils in the Eel River canyon, caused slides in every major excavation area. Extensive reconstruction and repair of excavation slopes had to be undertaken after each winter season. The most spectacular of these slides is the Hurlbutt slide, so named after the adjacent land owner. When first observed, this slide, by conservative estimate, had caused at least a million yards of material to start moving into the freeway cut.

To obtain at least marginal stability across this massive slide area, several corrective measures were undertaken. The level of the freeway was raised about ten feet to add more weight to the bottom of the slide. In addition, the bottom of the excavation was widened and the cut sloped was flattened. Several thousand feet of horizontal drains were placed in the fact and the flanks of the slide and other drainage installations constructed. These measures have arrested practically all movement in the slide.

In completing the slope protection work it was necessary to encroach slightly into the river bed area. Since the South Fork of the Eel is a tourist attraction and a popular fishing and swimming stream it was vital that the work disturb the stream as little as possible. The contractor was able to place 129,000 tons of rock slope protection with attendant trenching and build the Sylvandale Bridge without unduly muddying the stream.

On April 1, 1964, the state took bids for the construction of the fifth unit of the Redwood Freeway. This contract, to grade and pave a 2.4-mile stretch of freeway, was awarded also to Morrison-Knudsen Company, Inc.

On this contract, parking areas were built wherever possible to provide resting places for weary motorists and a

Prize-winning bridge, a "composite steel girder structure," crosses the South Fork of the Eel at Sylvandale as part of the new freeway unit and is five lanes wide to accommodate an acceleration ramp from the Sylvandale Interchange.

chance to view the magnificent scenery of the area.

This section followed the east slope of the canyon along the same general location as the old road.

The 1964 flood caused heavy damage to the partly completed contract. All but one of the overside drains on the contract were carried away, miles of guard railing were destroyed, the partly completed structural section was ruined by siltation, major crossdrains were badly choked with debris and great chunks of embankment were washed out. Repair work was begun as soon as possible and all damage was repaired by the time the rest of the contract was completed.

Slides both large and small occurred in all major excavation slopes. Of these, one deserves special mention. Though only 300 feet wide it extended over 1,100 feet up the mountainside. Its depth appears to be between 60 and 100 feet. It has moved slowly but perceptibly, like a huge mud glacier, ever since the excavation was started 18 months ago.

After considerable study it was decided that the most economical method of handling the slide was to widen the area along the freeway about 50 feet through the slide area. As the slide descended, material could be removed before it reached the edge of the freeway, using the widened space as a work area. To date, over 100,000 cubic yards of material have been removed in this manner.

The fifth contract also required of two channel changes in the river.

Another contract, let in May 1965, will extend the freeway another 7½ miles north from the town of Redcrest to Jordan Creek. Estimated completion date for this job is fall, 1967.

Funds are in the 1966–67 highway budget for construction of another 4½-mile section of the Redwood Freeway from south of Garberville to the south end of Unit No. 5. This contract, which will probably be advertised in February, should be completed the fall of 1967.

Seattle Public Library

MAY 9 1966

A photographic preview of a new

SIERRA CROSSING

"Route 190 is from Route 99 near Tipton to Route 127 near Death Valley Junction, via the vicinity of Porterville, Camp Nelson, Olancha, and Death Valley."

So reads the law, and the California Highway Commission therefore adopted the last 47 miles of this route last fall.

Adoption in this case is a long way from construction, but at least the precise location of the road is now known, and everyone can plan accordingly.

These pages show some of the rugged beauty of the Sierra along California 190 that will one day be opened up to the highway traveler and his family.

Packer and train (shown above) entering Monache Meadows heading west, about one mile north of Brader Meadows near Snake Creek. In rays of setting sun (left) pack train is unloaded at Beach Meadow Guard Station on edge of high plateau country.

Scenic Beauty

Packer Pete Mooch pauses at head of pack train along side of Kern River Canyon.

When it is completed, it will carry them from Tipton, Porterville and Springville in the rich central valley; through Quaking Aspen Meadow and Haiwee Pass in the High Sierra; then down through such thirsty prospectors' precincts as Panamint Springs, Stovepipe Wells and Furnace Creek to Death Valley Junction.

It is one of the future trans-Sierra routes that will "render accessible the mountain regions of the Pacific Coast," to borrow the words of the Sierra Club bylaws.

Another will be a road to Mineral King 25 miles to the north, which will make possible a multimillion-dollar ski and all-year mountain resort whose development the U.S. Forest Service will turn over to Walt Disney.

California 190 now runs from Tipton to Aspen Meadow, both in Tulare County, and stops. It picks up again 60 miles east, at Olancha in Inyo County on the Three Flags Highway, a nickname given to U.S. 395 because it connects Mexico, the United States and Canada.

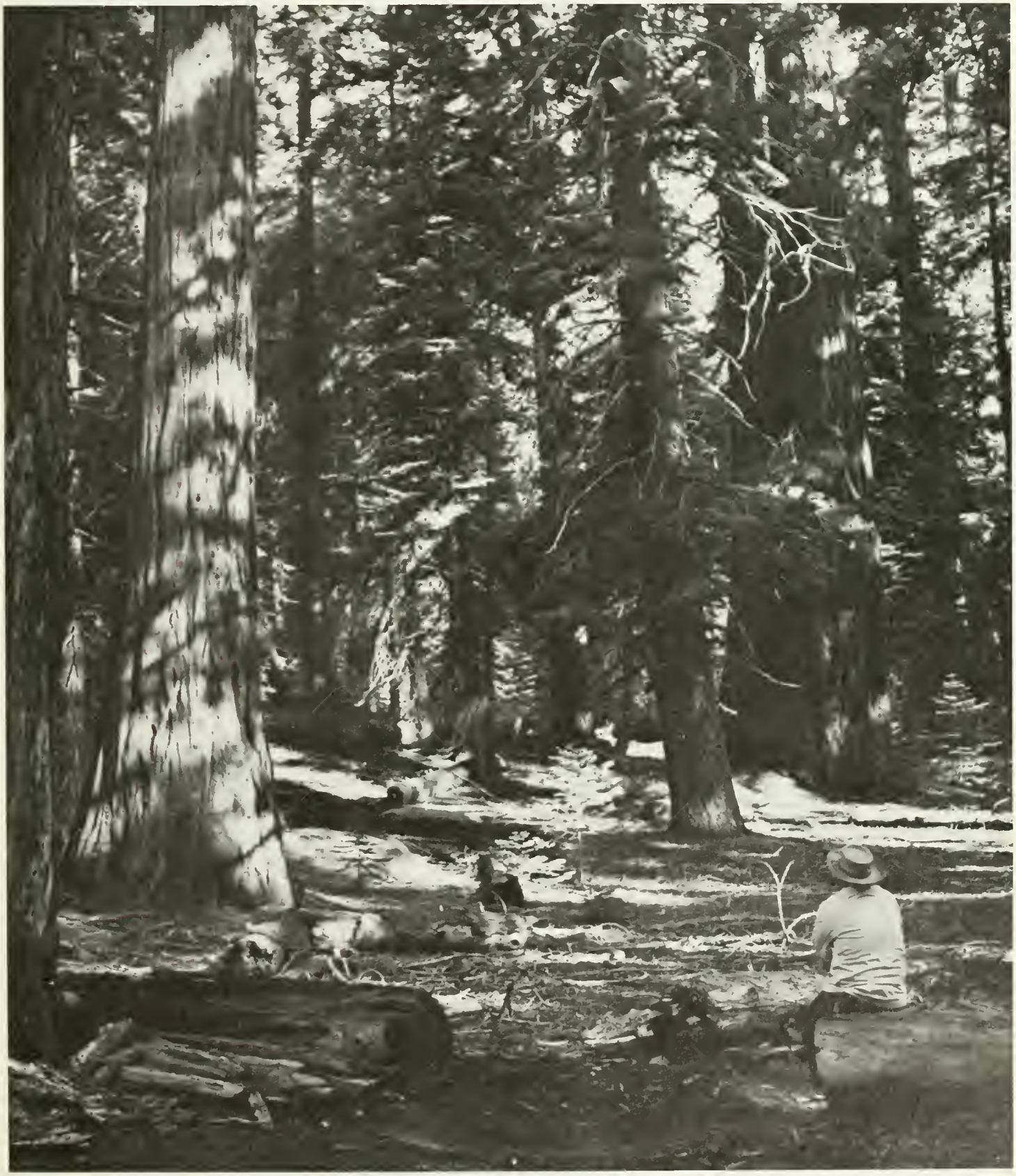
Except for those who live in the region, the 60-mile gap is open only to those who can afford the time and expense of a pack-train trip, or who have lots of leisure and the price of a four-wheel-drive wagon.

When chief photographer Bill Chaney made his photo reconnaissance of the route before the commission made the final adoption, he made it in the classic manner—by packhorse.

And packhorses, wranglers, diamond hitches and shelter tents will be the order of the day in this country even after the far-off day when the highway is finished, because it will run between two wilderness areas in a corridor purposely left to furnish access to them.

The highway will just make it that much easier for the city dweller to get to the packhorse country.

that will someday be made available to all



Trees are Sequoiadendron gigantea *(Sierra redwoods) and white firs, located in Freeman Creek Grove, a few miles and about two hours on the trail, northeast of Quaking Aspen.*

NEW VISTAS
for the recreational travelers

Packer Pete Maach (above) is Stanford University student who works as packer-guide in summer. Left, California calars in blue af mauntains and gald of grass. Train crassing Manache Meadaws near Deer Island, not far from Kern River, altitude abaut 8,000 feet. Below, left, Freeman Creek redwaad (Sequaiadendran gigantea) is little known grave not far fram Quaking Aspen and existing road's end. Belaw, view downstream along the upper Kern River, near Summit Creek at east side af Monache Meadaws and not far fram Haiwee Pass.

Ford on trail, right, across Kern River at about 5,200 feet, close to western end of route. Well-shod and competent-looking Boy Scouts, below, hiking along trail in Lloyd Meadows near Freeman Creek. Bottom, Edward Montes of California Division of Highways at campfire in Monache Meadows as morning mists arise around him.

PHOTOGRAPHED BY WILLIAM R. CHANEY

A NEW MARK FOR SAFETY

Photos above show various kinds of wedge and circular markers tested. Double wedge is smooth plastic; single wedge and circular type both contain reflective beads. In bottom photo Dwight Morrow of Headquarters Traffic Section shows markers which are currently being used—four nonreflective dots, and a reflective wedge white on one side, red on the reverse.

DIVISION ADOPTS BOTTS DOTS

In January the California Division of Highways scooped the world by announcing it was abandoning the painted white line on the state's highways. Henceforth, on all new construction, and in a gradual conversion program on other highways, raised markers will be used to separate driving lanes.

Since the painted white line tends to disappear in rainy and foggy weather when it is needed most, the Division of Highways has long been seeking a better lane-marking device. The markers adopted have been under study for more than 10 years. (See article in *California Highways and Public Works Magazine*, May–June 1963, by Herbert A. Rooney, senior chemical testing engineer.)

Officially the devices are to be termed "raised pavement markers" but they are known in some quarters as "Botts dots." The alliterative name comes from their association with one of their developers, the late E. D. Botts of the Division of Highways Materials and Research Laboratory. One company has chosen this for a trade name.

Photos above of section of Interstate 80 in Solano County show markers on a rainy day, and at night. Continuous white lines are headlights and taillights recorded in time exposure.

Both reflective and nonreflective types are to be used. Most of the markers called for in the new specifications will be nonreflective, of white epoxy, and laid on the pavement four in a line, three feet apart. Between these short nine-foot strips there will be an unmarked 15-foot space, then another group of markers. In every other open space, or, in other words, every 48 feet on straight sections of highway, there will be a reflective marker. On curves they will be placed every 24 feet.

The reflective markers presently accepted for use are two sided and made from a shell of clear acrylic material, filled with white epoxy. The exterior shell has "recessed cubed corners" molded into it which create a multitude of tiny mirrors to reflect the light back to its source.

Some of these reflectors will be white on one side, red on the other, to be used on freeways and other divided highways. They will be installed in such a manner they will reflect white light to normal traffic, but, should a wrong-way driver get on the roadway, he will see a row of red lights to warn him immediately.

Epoxy glues are being used to fasten the markers to the pavement. This material has been used for this purpose on a number of test installations and has proven to be virtually a permanent adhesive. A marker with a short spike has been developed for use on asphalt roads, the spike being designed to reinforce the fastening. The epoxy glue will not pull free, but conceivably a section of the asphalt might pull loose.

Although the markers will cost perhaps a dollar a piece installed, they actually will prove cheaper in the long run than paint. The painted white line must be renewed every six months on many routes, while the tests show the raised markers probably will remain in place for 20 years at least, with very few replacements.

The new markers not only will make driving easier, but they can be expected to cut down on accidents. In the Fresno area two similar sections of freeway on US 99 were studied over a two-year period. One was fitted with raised markers, the other marked only with the conventional striping. The markers, with the mild rumble effect they cause, were found to cut down lane changing 40 percent.

With reduced lane changing, the accident rate was reduced 27 percent. Injuries and fatalities were reduced even more, due to the elimination of many rear-end collisions. Indications also were the rumble often wakened dozing drivers when they drifted out of their proper lane.

Under consideration are yellow markers for centerlines. Also being sought is a harder cover for the reflective markers, which suffer from abrasion in desert sandstorms. A special recessed design must be developed for use in the mountains where snow removal equipment operates.

Being studied as more usable materials are polyesters and certain ceramics. These latter would be ideal if they had better tensile strength. They are cheap, whitest of all the materials under consideration, and properly installed should last almost forever. Permanently positioned in a manner that allows no movement, breakage should be low. Several test sections with ceramic markers are under study.

CALIFORNIA NUMBER ONE

CARSON PASS
WINS
NATIONAL
AWARD

A portion of the prize-winning section of Highway 88 as it passes Silver Lake, about 10 miles west of historic Carson Pass summit.

The rules for the PARADE Scenic Highway Contest:

1. The highway must be a new or rebuilt highway which opened to traffic after September 1, 1964, but before September 1, 1965.
2. It must be a highway for general use, not a special route for sightseers only.
3. It must "drive well," with gentle curves, easy grades and wide lanes.
4. It must be well planned, with good use of land, minimum destruction of property and neighborhood.
5. It must be designed to take advantage of natural terrain and scenic attractiveness.

On February 13th 30,000,000 people who read the Sunday newspapers subscribing to PARADE Magazine opened their copies and learned a section of California State Highway 88 had been chosen as the best designed scenic route built in the United States in 1965.

In the five years of the competition, this is the first time a winner west of the Mississippi has been chosen, although the Twain Harte section of California Route 108 was one of the five highways receiving honorable mention for 1964. Both 88 and 108 are in Highway District 10, with headquarters at Stockton.

The prize-winning portion of route 88—officially (Foster Meadows Road to east of Silver Lake"— was designed by a team headed by Louis G. Kroeck, senior highway engineer. Although the design work, like all California highway design work, was an accumulation of the efforts of many people, great credit must be given Kroeck for the painstaking work he did in fitting the highway into the terrain.

A native of Stockton, and son of a professor at the University of the Pacific, Kroeck learned to love the central Sierra while still a boy, and he still spends much of his spare time there indulging in his hobbies of hiking, photography, and painting. He and his wife Alice have walked over much of the old emigrant trail which Highway 88 generally follows, and as recently as 1964 they came upon an old rotted wagon wheel at the side of the trail.

Judges for the PARADE contest were John Gibbons of the Automotive Safety Foundation; Jack Wood of the American Planning and Civic Association; Charles N. Brady of the American Automobile Association; Wilbur O. Garmshausen of the Ohio Department of Highways, representing the American Society of Landscape Architects; and Jack Ritter of ENGINEERING NEWS-RECORD.

Route 88 is one of the state's most historic routes, crossing the Sierra at Carson Pass and it now continues into Nevada with the same route number, to end at US 395 just north of Minden. The pass was named by Frémont in 1844 for mountain man Kit Carson. Frémont and his party crossed here through deep snow in the dead of winter, but Frémont's usual luck held, and they encountered no bad storms.

At one point Carson climbed a high peak to reconnoiter, and discovered a large body of water to the north. This is the first recorded mention of Lake Tahoe by any white explorers, although at the time Frémont put it down on his map as Mountain Lake. (Later he named it Lake Bonpland, but in the 1850's Californians called it Lake Bigler after an early Governor. Eventually it got back its Indian name of Tahoe.)

At the summit of the pass, Carson blazed a tree, and then, within the blaze, carved "Kit Carson, 1844." For many years this red fir stood at the side of the trail, but eventually it died. The stump bearing the blaze can be seen at Sutter's Fort in Sacramento. A monument, State Marker 315, has been placed on the spot where the tree once stood.

In 1848, the Mormon Battalion, released by Kearny after playing its part in the conquest of California, returned to Salt Lake City via this route. Near Tragedy Springs three of the battalion's scouts, according to one story, were ambushed and killed by Indians, to give this point its name.

During the years of the Gold Rush many immigrant wagons came over the Sierra at Carson Pass, until better and lower passes were found farther north. "The Maiden's Grave," a few miles west of Tragedy Springs, marks the burial place of one of these immigrants, Rachel Melton of Iowa, who died there October 4, 1850. Nothing else is known about her.

The romantic years of stagecoach travel are marked by place names along the route which once designated hostelries for travelers. Names such as Kirkwoods, Picketts, Woodfords, and Hams dot the road's map from valley to valley.

The section which won the prize for 1965 is a part of a long-range modernization program which has been in effect on the route for several years, and much of it has been converted to modern highway. The paving of the winding, dangerous older section has been removed, the ground beneath deeply scarified, and planted with native vegetation. Two small sections—the Red Lake Grade just east of the pass and a portion from Woodfords to the Nevada state line—still remain to be modernized. This work will be done in the near future, to make 88 one of the state's finest scenic mountain highways.

Beauty and safer driving go hand in hand in new design

At Panther Meadow road passes through groves of relatively rare sugar pines, with yellow pine and fir mixed among them.

For those who pull off and sit by the side of modern scenic Highway 88, the ghosts of Fremont and Kit Carson will swing past with their mile-eating woodman's walk. Sit there a little longer and the sober-miened Mormon Battalion, homeward bound, will slog by. Next will come creaking covered wagons headed downgrade to the fertile valley below, and a little later great loaded freight wagons struggling upgrade, the mules straining in the harness and the skinner's whip cracking. Finally, a cloud of dust rises as a Concord stagecoach whips around one of the sharp curves of the old road, the yells of the driver hanging in the still mountain air.

Then comes a station wagon, loaded with parents, kids, and camping gear, and you are back in the 20th century.

Mr. Womack receives PARADE award from Mr. Kiester while Senator Jennings Randolph of West Virginia, chairman of the Subcommittee on Public Roads, and Federal Highway Commissioner Rex M. Whitton look on.

awards presentation

AT DENVER A.R.B.A. CONVENTION

In Denver on February 21 Mr. Edwin Kiester, Jr., managing editor of PARADE Magazine, made the official awards for the 1965 scenic highway contest before some 1,200 assembled members of the American Road Builders Association convention.

Mr. J. C. Womack, California State Highway Engineer, was present to receive a bronze plaque in the name of the California Division of Highways, and Mr. Louis G. Kroeck, senior highway engineer, to receive a scroll as chief designer. The Amador County Chamber of Commerce, which nominated the highway for the contest and prepared the presentation which won the award, was given a $500 bond. Mr. David Mason, Jr., president of the chamber, accepted the award for his organization.

Prior to presentation of the awards, Mr. Kiester addressed the body on the subject of scenic highways. Since the words of this sincere young editor seem to embody virtually all there is of importance to be said on the subject of highway aesthetics, the speech is reproduced here.

"The PARADE scenic highway contest has been in operation five years. This means that we slightly predate the current widespread interest in scenic highways on the government level. It does not, however, place us ahead of the American people in our interest in beautiful highways.

One of the first things we discovered in sponsoring the scenic highway contest is that people feel very deeply and very strongly about what they see through their windshields. In the first year of the contest we were startled to receive more than 400 letters of nomination, including some that enclosed poems, odes to beautiful highways, reminiscences of trips gone by, old photographs and even paintings. Since then we have had repeated evidence of this enormous interest on the part of the driving public.

Last Sunday, February 13th, as you probably know, PARADE announced the winning highway for 1966 in the pages of the magazine. Already we have received a blizzard of letters commenting on the selection.

What this says to us is that Americans—our readers—find in highways something more than mere transportation. Highways to them must not only be swift and secure but must bring them some kind of fulfillment, some nourishment of the soul, somehow bring them closer to this nation's wonderful landscape. I think the members of A.R.B.A. and of the entire highway industry are to be commended for recognizing, as they have, that this deep need exists, and for designing and building highways that are enlightening and uplifting.

So that brings me to the PARADE scenic highway for 1966. It is, as many of you already know, the Carson Pass Highway, State Route 88, in Amador County, California.

It fulfills all the spiritual needs I was discussing a moment ago. It is safe: its curves are sweeping, its lanes wide, grades gentle. It is swift: it replaces an old and tortuous winding road dating back a century. It is breathtaking: most of it is a mile high, and it threads along the forested Sierra ridgetops in such a way that you can truly appreciate the wonder of nature. And it is historic: this is the route the explorer Kit Carson followed into California, and driving it now, the motorist can get a compelling feel of pioneer history.

The engineers of the California Division of Highways were guided by the idea that they should not spoil this magnificent country, but enhance it, and they have done so. The route was planned to take advantage of the finest views. Working closely with the U.S. Forest Service, the engineers carefully installed 12 scenic overlooks and parking areas where motorists could pull off and drink in the

view. They followed a policy of selective thinning of trees and immediate planting of shrubs and seedlings. One of the features that especially impressed the judges was that they immediately obliterated the old, abandoned road so that this evidence of man's presence would quickly return to nature.

To the judges, this highway—indeed, all 25 highways included in the final judging—was a work of art. People don't think of highways that way, and they don't think of highway engineers as an artistic group, and yet these men are contributing to aesthetics just as much as those who build buildings, paint paintings or write music. One of the reasons PARADE established the contest originally was to recognize these artists and encourage others to follow them. Consequently it gives me great pleasure to make the first of these awards today to the artist responsible for the creative work that is the PARADE scenic highway—Mr. Louis G. Kroeck of the California Division of Highways.

I'm very happy to present Mr. Kroeck with the scroll given each year to the design engineer responsible for the winning highway, and to commend him and his men for the fine work done on Route 88.

As I said before, PARADE has been interested from the first in recognizing people and their feelings about highways. We have done this by offering a $500 bond to the person who nominates the winning highway and writes the best letter in support of his nomination. This year the winner is not an individual but an organization, the Amador County Chamber of Commerce, which is rightly proud of the work of art that runs through its area.

I also want to note that there are several other awards that will not be made today. These are for the five special-mention, or runnerup, highways, and these scrolls will be presented later. Meanwhile, I will just tell you that they go to the State of Massachusetts, for Interstate Route 495, Boxborough to Southborough; the Virginia Department of Highways, for Interstate Route 95, Fredericksburg to Woodbridge; the Pennsylvania Department of Highways, for Route 22-322, north of Amity Hall; Georgia Department of Highways, for Interstate Route 85, between Route 98 and 51; and the Vermont Department of Highways, for Interstate Route 89 in the Bolton-Richmond area of Vermont.

Finally, I have here a large bronze plaque that says flatly that California has built the most beautiful new highway in the nation.

It gives me great pleasure to present this to a gentleman I have known for several years, and who has long been interested in the subject of scenic highways, an official of your organization and the guilding spirit behind this year's winner—Mr. Jasper Womack of the California Division of Highways.

I thank you."

Proud local officials pose before Division of Highways exhibit in Denver. Left to right: Sidney Smith, manager of the Amador County Chamber of Commerce; Myron Questo, chairman of the Amador County Board of Supervisors; Louis Kroeck, design engineer, California Division of Highways, Stockton; Hubert Bruns, chairman of the Alpine County Board of Supervisors; and David Mason, Jr., president of the Amador County Chamber of Commerce.

Louis Kroeck, J. C. Wamack, and Edwin Kiester pose for press photos in Denver with PARADE award plaque.

PARADE'S SCENIC HIGHWAY AWARD

1965

Presented To

CALIFORNIA DIVISION OF HIGHWAYS

FOR

CARSON PASS HIGHWAY

FOSTER MEADOWS ROAD TO SILVER LAKE

(AMADOR COUNTY) CALIFORNIA

A HIGHWAY CONCEIVED WITH IMAGINATION

AND CONSTRUCTED WITH DEVOTION

TO THE BEST PRINCIPLES OF

DESIGN, PLANNING AND UTILITY

interstate 5 freeway

DISTRICT SIX

By GEORGE FLUTER

A major highway on the west side of the San Joaquin Valley has been the subject of discussion for at least 40 years. Now, with the aid of the federal interstate program, it is taking shape.

Most of the cities on the west side of the San Joaquin Valley developed and were incorporated during the first quarter of this century and as they grew the need for a good highway became acute.

However, because of the many uncontrolled rivers emptying into the valley, much of the area was often swampy or, in wet years, completely under water, making a good connection across the valley to US 99 difficult.

A "Westside Highway Association" was formed, and in 1925 Assemblyman Charles A. Foster of Fowler introduced a bill in the Assembly for funds to survey a route between Mendota and Ventura. The Governor vetoed the bill.

Later, at the request of the boards of supervisors of Kings and Fresno Counties, the Highway Commission requested State Highway Engineer R. M. Morton to study a route for a west side highway. In March 1926 the Highway Commission adopted the State Highway Engineer's report. It is of interest to review his recommendations of 40 years ago, as quoted in the "Fresno Republican" (forerunner of the "Fresno Bee"), March 5, 1926:

"It should be one-half mile distant from parallel railroad lines, to permit local industrial development and expansion. It should avoid railroad crossings and those necessary should be separated from the highway grade. Grade separations for intersecting highways and streets should be considered.

"Its right-of-way should have sufficient width for two high-speed one-way traffic lanes, each 30 feet wide and separated by an unpaved strip. Reservation of 20 feet should be allowed for the planting of trees and parking on roadsides. Outside of this width there should be roadways for slow-moving, short-distance traffic, and for heavy trucks. Two hundred feet of right-of-way will be required and should now be provided."

Morton's recommendations were not followed. Subsequent highway development was along conventional standards, becoming State Sign Route 33 as we know it today.

It was not until 1939 that the Arroyo Seco Parkway, the first freeway in California, was finally constructed. It is noteworthy how striking a similarity this road bore to Mr. Morton's description for this recommended Westside Freeway of 13 years before.

The first post-World War II study of the route was made when the 1950 Legislature directed the Division of Highways to investigate the pros and cons of building a toll road between Los Angeles and San Francisco, financed by toll revenue bonds. The division's report to the Legislature concluded that such a toll road was not financially feasible at that time, primarily, because it would face competition of free parallel freeway routes (Highway 99, etc.).

However the data accumulated during this toll road study proved helpful six years later when the Legislature again instructed the division to reinvestigate the construction of a high-speed highway on the west side of the San Joaquin Valley between Woodland and the Grapevine Grade. This report concluded that such a highway was feasible and would cost approximately $261,000,000. The 1957 Legislature added the route to the state highway system.

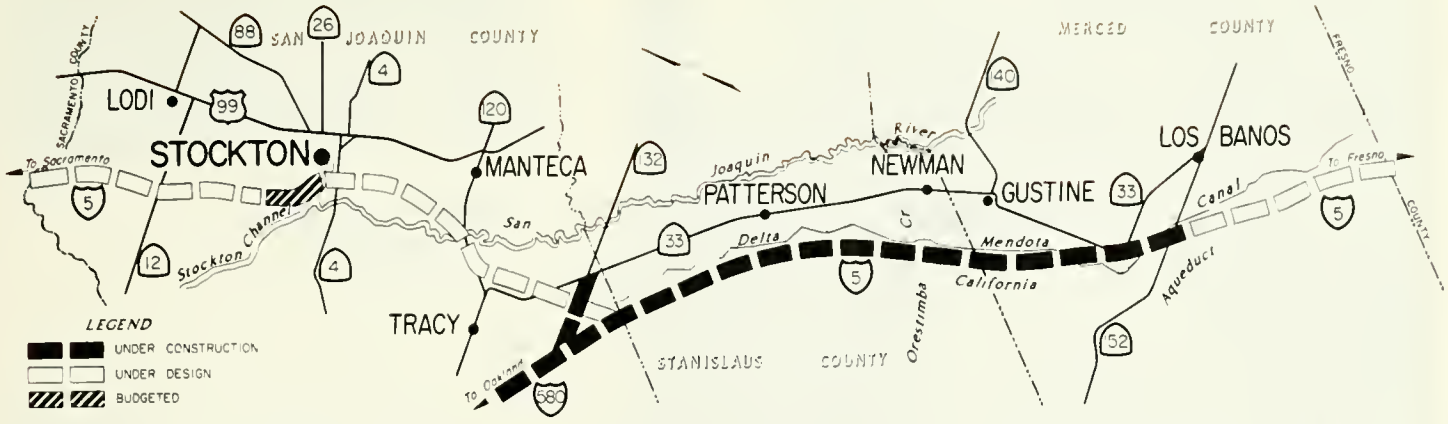
Immediately, the division started detailed route studies on several alternates for consideration by the California Highway Commission. (See "Westside Freeway," September–October 1960 issue, "California Highways and Public Works.")

The first construction contract in District 6 was awarded in April 1965. Approximately 21 miles long, it extends from Manning Avenue to the Merced county line.

Work is now going on in all counties on the Westside Highway.

One of the problems encountered in construction has been soil subsidence described in an accompanying article in this issue.

Among other construction highlights: On the southern 16 miles of Route 5 in Kings County, which lies across farming and grazing land and through the Kettleman Hills, independent roadways will be used to enhance the aesthetic quality of the freeway. The interchange with Route 41 will lie within this hilly terrain. Its design includes contour grading to



As indicated by the dotted line on the above map Interstate 5 is being constructed on entirely new alignment along the west side of the San Joaquin Valley.

blend excavation slopes with natural ground lines.

An interchange at Utica Avenue will be near the site of a future aquatic park.

A safety roadside rest will be built approximately 3½ miles north of the Kern county line.

Along the 66 miles of Route 5 in Fresno County, which also crosses farming and grazing lands, grades are mild on approximately 60 miles of the project, requiring only low cuts and fills no more than three or four feet high. On the remaining six miles, grading will be heavier requiring cuts and fills up to 40 feet.

Independent roadways and separated grades will be used on much of the alignment as a scenic feature.

Two safety roadside rests will be built in Fresno County, one 5½ miles south of the Derrick Avenue crossing and the other two miles south of Shields Avenue.

The amount of farming land affected by the freeway presented special problems to the design and right-of-way departments who had to complete adjustments to irrigation facilities in time for the work to be included in the construction contracts.

The problem was further compounded by the imminent development of the California Water Plan which will bring many new acres under irrigation.

The rehabilitation of irrigation systems was given priority over other right-of-way activities because of the critical importance of maintaining irrigation schedules to avoid crop losses.

This bleak scene along Utica Avenue in Kings County will be the location of an Interstate 5 interchange and an aquatic park.

This construction site along Interstate 5 in Fresno County will be the location of an interchange with Panoche Road.

interstate 5 freeway

DISTRICT TEN

By George B. Avery and
R. Kenneth Wells

The new Westside Freeway follows the western edge of the San Joaquin Valley high up on the alluvial fans that have formed at every creek mouth. Over eons of time, these have joined together to form a fluted edging to the barren hills. The engineers have used various means to blend the design of the new highway into this setting so that it will become a part of the fluting pattern by locating it at the natural dividing line between arable and grazing land. Little farm land will have to be taken and severence has been held to a minimum.

The new highway also parallels the California Aqueduct and has been designed to complement it. Vista points are planned to provide the traveler with outstanding views of the central valley, the foothills, the aqueduct, and the Delta-Mendota Canal.

Throughout the life of this project the engineers have continually weighed engineering costs against appearance to build a highway which is economically as well as aesthetically acceptable. Roadway alignments and grades were combined to achieve a pleasing effect. A lot of attention was given to the interchange areas so that they would blend with the surrounding countryside.

There are several areas where large valleys lie to the west of the freeway. At these locations interchanges and underpasses will permit free circulation of local traffic as well as easy access to the freeway.

The construction of this modern freeway through new territory involved 800 parcels of land. In order to acquire this land in the most economical manner and cause least disruption to existing operations, the Division of Highways entered into a cooperative agreement with the Department of Water Resources to obtain the necessary rights-of-way for both the freeway and the California Aqueduct in one transaction with each property owner. As an indication of how little displacement occurred to the residents, only two homes were acquired in Merced County because of the freeway. None were acquired in Stanislaus County. Irrigation pipelines have been installed to preserve existing irrigation and drainage patterns.

Where the new highway and canal cross the pipelines connecting oil fields near Bakersfield and refineries in the San Francisco Bay area, agreements have been entered into to preserve or relocate the lines. In some areas, local irrigation districts have revised their facilities.

The interstate highway law commits us to a 1972 construction completion date. One result is that where formerly projects 5 miles in length were considered large, it has been necessary in this district (10) to advertise projects as long as 15 miles. (District 6 has a single contract underway on Interstate 5 in Kern County that is 24 miles long.)

These large contracts allow the contractors to work at maximum efficiency. Equipment manufacturers have produced machines to meet the demand. Paving trains have been organized that can lay a mile of concrete 24 feet wide on a single day.

Several projects involved moving nearly four million cubic yards of earth. Contractors employed two running shifts on excavation operations and moved as much as 40,000 cubic yards of earth in one day.

As these projects went to construction, the demand for base and surfacing aggregates jumped from thousands to hundreds of thousands of tons. Plants that worked intermittently in years past found themselves working around the clock. At least a dozen plants are now in full production making aggregates not only for base and surfacing on the freeway but also concrete aggregates to line the tremendous California Aqueduct.

The traveler on this new freeway will have a panoramic view of the full sweep of the San Joaquin Valley.

The Department of Parks and Recreation is vitally interested in the development of the freeway. Their future plans have the freeway traveler in mind. Five wayside campground sites are currently being studied along the aqueduct and the Interstate 5 Freeway. Typical of these is Orestimba Creek in Stanislaus County. Fifty-four acres are being acquired west of Stuhr Road at a large grove of mature cottonwood and sycamore trees next to Orestimba Creek. One hundred camping units will be constructed here for tent and trailer campers. The entire area will be landscaped and irrigated to handle year-round vacation traffic.

A 60-mile section of Interstate Routes 5 and 580 are under construction or budgeted between US 50 west of Tracy and Route 152 west of Los Banos. These projects should be completed and open to traffic by the summer of 1967, providing an entirely new artery for traffic between the bay area and Los Angeles and intermediate points in the San Joaquin Valley.

The eighth and last contract is for the three-mile section from Sybil Avenue in San Leandro to 173rd Avenue near the Castro Valley Interchange and follows the general route of Foothill Boulevard (the extension of MacArthur Boulevard). The project, which will be completed soon, will cost $5,174,000.

A nearly completed section of Interstate 5 Freeway northwest of Las Banas in Merced Caunty. The area and cannecting lanes left of the north-bound raadway are for a truck weighing station. The view is southward.

The new Interstate 5 Freeway follows the natural dividing line between arable and grazing land along the west side of the San Jaaquin Valley.

interstate 5 freeway

SUBSIDENCE AND THE WESTSIDE FREEWAY

By William F. Kleiman

Much of the Westside Freeway (Interstate 5) cuts across the alluvial fans and mud flows extending into the San Joaquin Valley from the east side of the Coast Range. These fans contain soils that tend to settle when saturated with water for a long time.

Soil subsidence studies on this and other areas have been carried on by engineers, geologists and technicians of the California Division of Highways, California Department of Water Resources, the United States Bureau of Reclamation, and others.

These studies show that the areas of shallow .subsidence contain fine grain loose-packed soils but that there appear to be concentrations of these soils rather than a uniform distribution throughout the entire mass. Rainfall in the areas is low, three or four inches a year, most of it coming from infrequent storms during the winter months. Quick drying of the mud flows followed by an extensive drying period produces a porous soil mass cemented together by clay particles. Such soil is stable under normal conditions, but when saturated, it crumbles and settles.

This phenomenon has long been a thorn in the sides of canal builders and pipeline companies operating in the west side of the San Joaquin Valley because settlement of the ground during irrigation has caused vertical distortion of canals, pipelines and farm roads.

Preliminary studies on the design of the Westside Freeway required a great deal of laboratory and field testing and offered special problems. For one thing, the natural ground water through this area is more than 200 feet below the ground surface. One of the conditions necessary for estimating settlement is that the specimen be tested in a **natural** saturated condition. Results of the conventional consolidation test performed in the laboratory were not considered applicable for predicting settlement in the field.

Thus, a modification to the standard consolidation test was made. Water was added to the test specimen and a constant vertical pressure maintained after the specimen had been consolidated at field moisture content under some predetermined pressure. From this an estimate of subsidence due to saturation could be made.

Several field subsidence test plots were operated for several months. These test plots were situated at the same locations from which samples were obtained for the laboratory tests. Subsidence occurred as water saturated the ground and elevations were determined at time intervals on the surface and at 20 feet and 40 feet beneath the surface. Correlation between estimated settlement from consolidation test and observed settlement of the subsidence plots was good to fair for four locations and very poor for two locations. On the basis of consolidation tests, field reconnaissance, and other data, areas were placed into two broad categories (1) those that would subside a negligible amount, say less than one-half foot, and (2) those that would subside several feet. The findings also showed that no one soil characteristic correlated very well with known subsidence so that it would be necessary to consider all possible factors including personal judgment based on field observations.

Conclusions of these investigations were:

1. In the areas where major subsidence can be expected: (a) secure approximately 150 feet of additional width outside the normal right-of-way on both sides; (b) provide drainage to prevent ponding of water from irrigation or surface runoff within approximately 125 feet of the freeway embankment; (c) provide cross culverts at all natural drainage channels and additional cross culverts along the line at intervals not greater than 300 feet.

2. Specify compaction of original ground under all embankments in all areas of major or minor potential subsidence.

Water Resources is even more concerned with subsidence than is Highways, especially deep subsidence which occurs over large areas to depths of 300 feet or more. Deep subsidence seldom causes settling that seriously affects highways. However, maintenance of a profile grade is vital for aqueducts and canals and deep subsidence can alter gradients so that flow is greatly reduced. Highways can often avoid subsidence areas by being relocated, but studies of alternate alignments by Water Resources indicated that it was not practical to bypass the subsidence areas with the aqueduct.

Construction of the aqueduct required a different approach to the subsidence problem than highway construction. The Division of Highways tends more to **preventive** treatment. Water Resources must use **corrective** treatment as water in a canal constructed without treatment would result in excessive maintenance and operation costs and disruption of water deliveries to the southern part of the San Joaquin Valley and southern California.

Special studies were conducted at

49 locations over approximately 200 miles of the aqueduct alignment. Subsidence ranged from less than 1 foot to more than 20 feet. The largest subsidence occurred south of Buena Vista Lake in Kern County and at the Mendota test site in Fresno County.

At the Mendota site a prototype canal was constructed. The first phase consisted of maintaining water in simple ponds measuring 200 feet by 400 feet. At the first pond, nearly 16 feet of subsidence was observed after maintaining a constant depth of water of one foot in it for 16 months. After compaction of the native soils by saturation, a prototype canal was constructed through three of the test ponds. The canal was 1,400 feet long and the ponds or plots are separated by cut sections of native, uncompacted soil. One-half of the canal was concrete lined and the other half was lined with a heavy compacted earth lining.

After the canal had been inundated for 90 days, the concrete lining and embankments in the uncompacted areas were badly cracked. After 130 days of operation, the earth-lined section showed signs of distress and collapsed shortly afterward.

The concrete-lined and earth-lined sections in the precompacted areas were in excellent condition after the test canal had been in operation for almost a year.

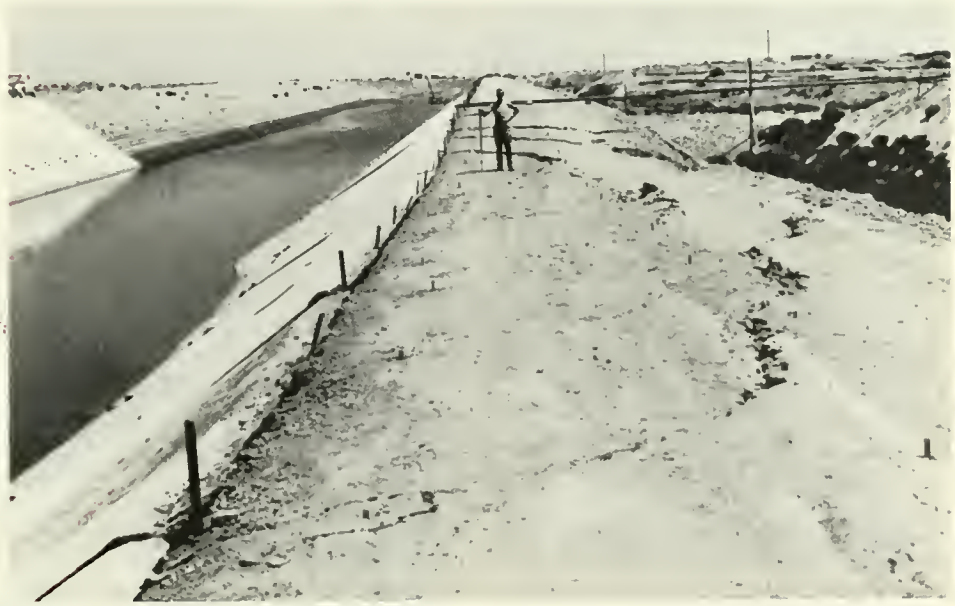
The California Division of Highways and the Department of Water Resources have projects currently under construction through areas of shallow subsidence on the west side of the San Joaquin Valley.

The preventive method used by the Division of Highways consists of extensive drainage facilities to prevent ponding of water near any embankments. The first contracts include grading only of the freeway embankments. Paving will be done after the embankments have been in place for at least one year. The completion of the freeway is scheduled for 1972.

In the case of the State Water Plan aqueduct it is believed that precompaction by ponding and saturation will enable construction of an aqueduct which will be relatively free of settlement. Water is being maintained in the ponds for an average of six months, and a drying period of one year will be required prior to construction of the aqueduct. Present plans call for completion of the precompaction work in 1967.

An aerial photo of a prototype test canal built by the Department of Water Resources some 15 miles south of Mendota. Note concrete-lined and earth-lined portions.

Failure of the earth-lined section in the noncompacted portion of the prototype test canal after 130 days of operation.



Failure of concrete lining and embankment in noncompacted portion after inundation of the prototype test canal for 90 days.

interstate 5 freeway

COMPACTION CONTROL with NUCLEAR GAGES

By William G. Weber, Jr.

The Numec backscatter gage (on ground left of truck) reflects gamma rays back from the soil.

The first use of a nuclear soil gage on a construction project for compaction control in California was in 1964 on a project in District 1 (Eureka). As a result of this study the present program using soil gages on 10 construction projects was initiated. Two of these projects are on Interstate 5 (Westside Freeway).

Two types of nuclear density gages are being used: backscatter and transmission. The backscatter type reflects gamma rays back from the soil which are counted by a detector. This type is being used on a District 6 project. The transmission type counts the gamma rays penetrating a soil mass. The gage requires either a nuclear source or detector placed in the soil mass. This type of gage is being used on a District 10 project. So far, test results indicate that the transmission-type gage is to be preferred.

The material on the project in District 6 consists almost entirely of roadway excavation and borrow from alluvial fans which has outwashed from the adjacent slopes on the east side of the Coast Range. In the process of erosion the soil has only been transported short distances so that the degree of abrasion has been relatively minor. Hence, although the material is predominantly fine grain, many of the soil particles consist of small pieces of parent material such as shale and sandstone in a badly weathered condition. The materials tested with the nuclear gage on this project are roadway excavation, borrow and structure backfill. No structural section material was included. The gage used is a Numec.

The roadway excavation for the District 10 project is predominantly sedimentary, consisting of fat clays, shales, poorly cemented sandstone, clean fine sands, sand and gravel, conglomerates and other materials. The layers vary in thickness from a fraction of an inch to several feet and great variation may exist even in small cuts. Thus, a scraper of fill material might consist of any one of the above materials or any sort of combination of materials. This complicates testing because the test at one spot may not be representative of conditions in nearby areas. A Troxler (transmission type) gage is being used on this project.

Calibration of the gages and preparation of the soil surface for nuclear testing has presented some problems, especially with the backscatter type. Both types of gages require the soil to have a plane surface that is in full contact with the bottom of the gage. This means a lot of time being spent in test site preparation. Methods are being developed which will reduce this preparation factor.

Health and safety factors have presented no problems so far. The gages use only a very small amount of radioactive material and film badges and dosimeters are worn by the operators to record the radiation that they receive.

In spite of the problems mentioned above in the use of the nuclear gages, valid density readings have still been obtained. However, experience shows there is need for improvement to make the gages easier to use to get even more accurate readings.

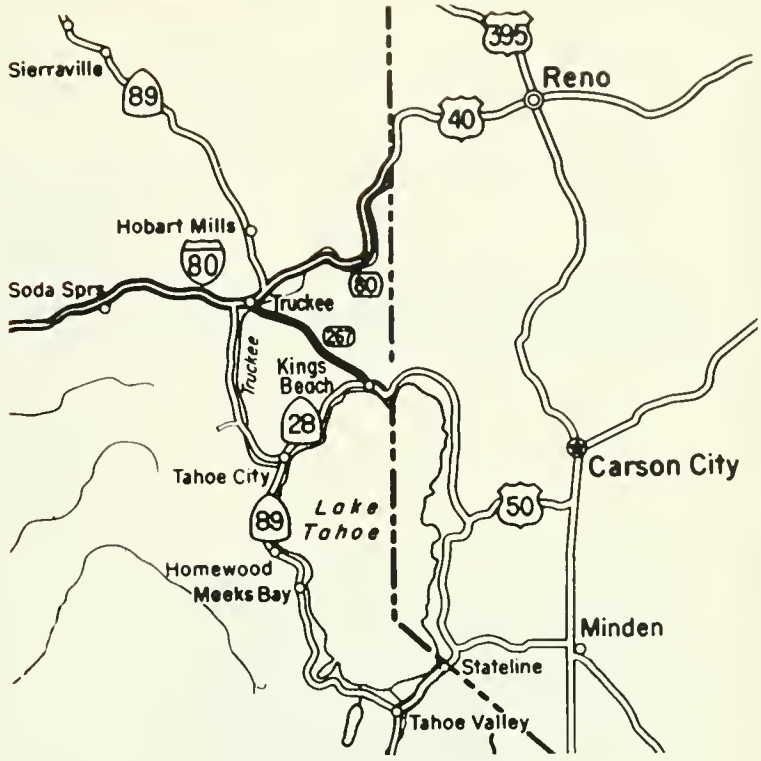
The Troxler transmission gage being set in place here counts gamma rays penetrating a soil mass.

The new feature in the nuclear test method is in the use of the area concept; that is, several tests performed in a given area. Normally there should be at least six tests taken in any specified area. The average compaction reading from the tests must be higher than compaction value required in the job specifications (the higher the reading on the gage, the more compacted the soil). Also, two-thirds of the individual tests must give results above the compaction value required in the job specifications.

This method of testing recognizes that variations in relative compaction are normal in earthwork. Variations such as layer thickness, coverage with rolling equipment, moisture content and variation in material will cause slight variations in the compacted densities. The area concept is an attempt to allow for these variables.

The use of the nuclear testing on the Westside Freeway is increasing the effectiveness of earthwork compaction control. The difficulties encountered so far in nuclear testing do not appear insurmountable. There is little doubt that use of nuclear testing will increase as time goes on.

Truckee - Brockway Shortcut



One of the newest additions to the 4,200-mile state highway system is a 3-mile stretch in the Lake Tahoe region.

The Brockway Shortcut has long been known to nearby residents as the most direct route from Interstate 80 at Truckee to Kings Beach, Crystal Bay and North Shore. It is some eight miles shorter than its alternate—a combination of State Routes 89 and 28 which passes by the Squaw Valley entrance and meanders through the resort area which borders Lake Tahoe's northern shore.

This route has provided a popular access to Lake Tahoe in recent years for local residents and others familiar with the region. Now, it has been improved to state highway standards with county, federal and state matching funds.

The new signing as a state route (see photo on right) now assists other motorists seeking the shortcut.

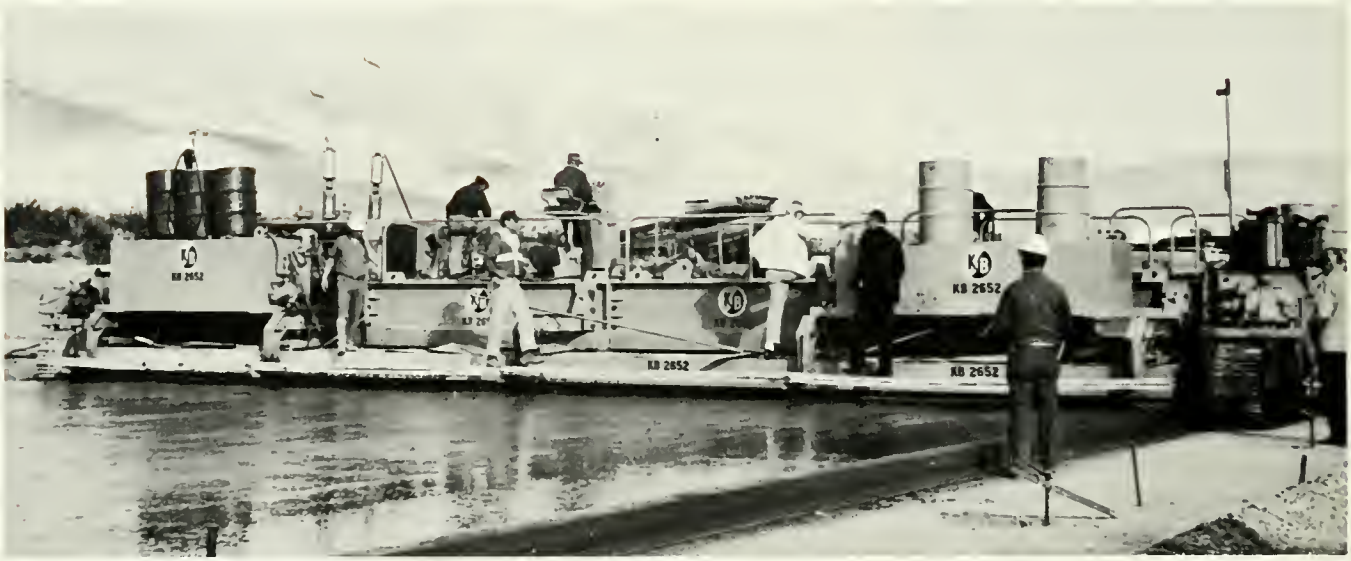
Although Interstate 80 must receive first priority in snow removal operations in the severest winter conditions, additional equipment assigned to the Truckee area is making it possible to keep the route open in most storms.

Route 267 was authorized by State Senate Bill 1081 (introduced by Senator Paul Lunardi during the Legislature's 1965 General Session) and adopted by the California Highway Commission on September 22.

Signs on Interstate 80 near Truckee, above, indicate place to turn off main route to use new state cutoff. Left, Route 267 is modern, well paved, with easy grades. Road continues to left to drop down to shore of Lake Tahoe, scenic view of which is seen in distance.

"instant freeways"

SAN BERNARDINO FIRM DEVELOPS FIRST FOUR-LANE PAVER



Jeff Kasler (in white jacket), president of Kasler Corporation, shows C. V. Kane (in black business suit), California Division of Highways' district engineer for San Bernardino and western Riverside Counties, the highway construction firm's modified slipform cover.

BY PAUL BROWN

Two extensively modified pieces of paving equipment are making freeway construction history in Riverside County.

For the first time anywhere, a contractor has equipment which successfully paves a four-lane-wide ribbon of smooth concrete pavement.

Motorists probably aren't going to get too excited over this feat which has impressed engineers and highway construction people. But drivers do recognize and appreciate a smooth-riding highway. And this newly modified machinery is producing a ribbon of extra-smooth pavement.

The equipment—a slipform paver and a pipe float which represent a $255,000 investment and four months of intensive modification work—went into operation early this year on a freeway construction project on Interstate 10 about eight miles northwesterly of Palm Springs.

Slipform pavers capable of producing three-lane-wide continuous concrete pavement have been in operation for the past several years.

But the Kasler Corporation, of San Bernardino, is the first firm to achieve success with a 48-foot-wide pavement venture.

Jeff Kasler, the firm's president, modestly reports that credit for the successful operation goes to his master mechanic, San Bernardino resident Curly Toles. Kasler also expressed his delight over the extra-smooth pavement produced by the machinery.

Another man impressed by the historic event is C. V. Kane, California Division of Highways' District 8 engineer.

"It's a milestone in concrete paving operations," Kane emphasized.

"Kasler's slipform paver and plant setup," Kane pointed out, "are capable of running about 550 cubic yards of concrete an hour!"

The district engineer noted that when he started working for the Division of Highways as a draftsman in 1928 a concrete paving operation would run 200 to 300 cubic yards of concrete in an eight-hour shift. Conventional three-lane-wide pavers today spread about 250 to 300 cubic yards an hour.

Modern high-speed traffic demands high standards of pavement smoothness. And Kasler's 48-foot slipform paver and pipe float are meeting this high standard, Kane reported.

Engineers, using a specially designed gauge, measure pavement smoothness and rate it under a standard called a profile index. The Division of Highways will accept pavement with a profilograph reading of 7 inches per mile or under.

If the index goes over 7, the contractor must grind down the pavement to achieve the desired smoothness of surface. The profile index on the first four-lane-wide pavement produced by Kasler's equipment is 1.2!

Kasler reported that the modification work involved changing a manufacturer's slipform paver—a slope paving machine purchased in 1964 and used to pave flood control channels—into its present form as a 48-foot-wide highway paver. The modification work included designing a new electronic control panel to operate the machine. He said the original paver was $200,000 and the modification job cost $40,000.

Also reconstructed was a 24-foot power-driven pipe float (which follows the paver and smooths down the freshly laid pavement). This piece of equipment originally cost $8,000. Kasler said modifications on the float cost $7,000.

These two successfully modified pieces of equipment are being used on a construction project to upgrade an approximate five-mile section of four-lane expressway to an eight-lane freeway.

The $4.5 million job, scheduled for completion about next August, is located on Interstate 10 between Cabazon and the Route 10/111 junction. This project is a joint construction venture of Kasler Corporation, Gordon H. Ball Enterprises and the E. L. Yeager Construction Company.

and smoooth!

Workman removing guide wiring helps illustrate the size of this pipe float, which was modified to do a 48-foot-wide strip.

This freshly laid ribbon of concrete pavement on freeway construction project, Interstate 10, about eight miles northwesterly of Palm Springs, is first successful paving of four lanes at one time.

THE UKIAH FREEWAY

By L. B. Dwyer

A 5½-mile freeway section around Ukiah which was opened on November 8, 1965, completes freeway construction on the Redwood Highway (US 101) from six miles north of Hopland to north of Calpella, a distance of 14½ miles.

The City of Ukiah is approximately a 2½-hour drive north of San Francisco. It is the Mendocino county seat and its largest city (population: 10,000). The surrounding area is noted for its pear and walnut orchards, vineyards and large cattle ranches. Several wood product manufacturers are also located in and around Ukiah. The city is a natural stopover for meals and lodging for business and vacationer traffic using US 101.

The new freeway is located generally to the east of Ukiah and is relieving the city of heavy trucks and bumper-to-bumper traffic, allowing local customers easier parking and more leisurely shopping. Through traffic saves 15 minutes by using the freeway and missing the downtown congestion

The freeway was constructed to blend in with the surrounding area by contour grading and seeding of slopes. A functional and tree-planting project planned for this spring will further enhance its appearance.

The first of five contracts which constructed this 14½-mile stretch of freeway was started in 1961 and completed in November 1962. It included 13 bridges and partial grading from Ford Road to 0.8 mile south of Forsythe

(Left) Looking north over new freeway section toward Calpella and Redwood Valley
(Below) Ukiah in distance, in foreground simple "trumpet type" interchange which joins State Route 20 to Redwood Highway.

Creek. The contractor was Guy F. Atkinson. N. A. Gust and John Brown, Jr., were resident engineers. Job cost was around $1,600,000.

A second contract for 5½ miles from Ford Road to ½ mile south of Forsythe Creek was started in April 1962 and completed in January 1964. Contractor was Frederickson Brothers; E. J. Reed, Jr., was resident engineer. Project cost was $2,400,000.

Work started on the third contract in June 1963 and was completed in July 1964. It included construction of the southern four miles of the freeway and included three bridges. Hooker Co. and Fredrickson & Watson Construction Co. were the contractors; resident engineer was Albert J. Braga. Project cost was $2,200,000.

The fourth contract between one-half mile north of Robinson Creek and North State Street included 11 bridges. It was completed in the fall of 1964. Contractor was Gordon H. Ball; Fred Graebe and Wynn Norsworthy were resident engineers; and P. A. Main, W. B. Sperry and L. L. Younie, District 1 representatives on the $2,000,000 project.

The last contract between Robinson Creek and North State Street, some 5½ miles, was started in the fall of 1964, completed in December 1965 and cost $2,750,000. It connected the two previously constructed freeway sections. Contractor was Gordon H. Ball; L. B. Dwyer, the resident engineer.

Bylines

William G. Weber, Jr. (1), who wrote "Compaction Control With Nuclear Gages," is a native San Franciscan and a graduate of the University of California at Berkeley. He joined the Division of Highways in 1949. Now a senior materials and research engineer, his specialities include soft foundations and use of nuclear gages to measure soil compaction.

"Interstate 5 Freeway—District Ten," by George B. Avery (7) and R. Kenneth Wells (2).

Mr. Avery is assistant design engineer for the Division of Highways in the Stockton district office. A native of Stockton, he is a graduate of the University of California at Berkeley and came to work for the division in 1953. He is past president of the Central Valley Branch of the American Society of Civil Engineers.

Mr. Wells, also stationed in Stockton, is report engineer for the district. He was born in Santa Cruz and joined the division after his graduation from the University of California in 1931.

Author of "MacArthur Freeway" is Dale C. Ryman, (3) now assistant district engineer of the Division of Highways San Francisco office. A native of South Dakota and graduate of South Dakota State College, Mr. Ryman joined the division in 1946. A highlight of his prestate career included a two-year stint as relocation engineer on the $300,000,000 Panama Canal Third Lock project.

William F. Kleiman (4), author of "Subsidence and the Westside Freeway," was born in Kansas City, Missouri, and moved to California in 1935. He graduated from the University of California at Berkeley in 1940 and joined the Division of Highways in 1947. He is a soils engineering associate with the Materials and Research Laboratory. His specialty is stability of embankments.

Paul Brown (5), author of "Instant Freeways," was born in Chicago, and came to California in 1944. He is a graduate of the University of California at Los Angeles. Before coming to work as assistant information officer with the Division of Highways San Bernardino office in 1964, he worked as a reporter and photographer for newspapers in southern California.

"Dean Creek to Miranda," by H. W. Benedict (6). Mr. Benedict was born in Colorado Springs, Colorado, and moved to California at an early age. He attended Oregon State College and joined the California Division of Highways in 1941. Now a highway engineering associate, he has served as resident engineer on many large highway construction projects in northern California.

"Interstate 5 Freeway—District Six," by George Fluter (8). Mr. Fluter is a senior highway engineer in design with the Fresno office of the Division of Highways. He was born in Centralia, Washington, and moved to California when still young. He is a graduate of the University of Redlands and joined the Division in 1947. He was in charge of design for the Bakersfield Bypass and Grapevine Grade sections of Interstate 5.

"The Ukiah Freeway," by L. B. Dwyer (9). A native of Tupper Lake, New York, Mr. Dwyer attended Rensselaer Polytechnic Institute in Troy and the University of California at Berkeley. He joined the California Division of Highways in 1948. He is a highway engineering associate and has been resident engineer on highway projects in central and northern California.

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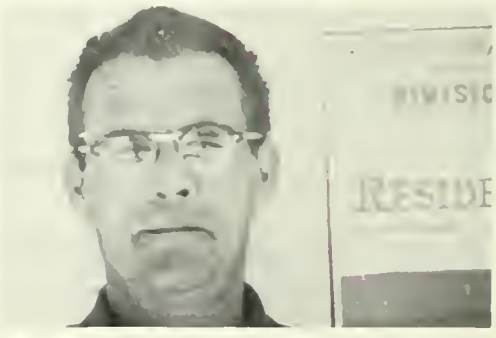
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EDMUND G. BROWN, *Governor*

TRANSPORTATION AGENCY

ROBERT B. BRADFORD . . . Administrator

DEPARTMENT OF PUBLIC WORKS . . . JOHN ERRECA, Director

FRANK A. CHAMBERS . . . . Chief Deputy Director

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HARRY D. FREEMAN . . Deputy Director (Planning)
T. F. BAGSHAW . . . . . Assistant Director
C. RAY VARLEY . . . . . Assistant Director
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R. V. POTTER . . . . Systems Research Engineer
PAUL C. SHERIDAN . . . . . Office Engineer
E. L. TINNEY . . . . . Maintenance Engineer
DONALD P. VAN RIPER . Principal Landscape Architect
J. E. WILSON . . . . . Traffic Engineer
A. L. ELLIOTT . . . . Bridge Engineer—Planning
H. R. HINEMAN . . . Bridge Engineer—Operations
R. J. IVY . . . Bridge Engineer—Administration
DALE DOWNING . . Bridge Engineer—Southern Area

Right of Way

RUDOLF HESS . . . . . Chief Right of Way Agent
HARRY L. KAGAN . . . . . Assistant Chief
DEXTER D. MacBRIDE . . . . . Assistant Chief
R. S. J. PIANEZZI . . . . . Assistant Chief

District 1, Eureka

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VOLUME 45 MAY-JUNE NOS. 5-6

THE REDWOOD EMPIRE 2

SHASTA-CASCADE WONDERLAND 8

ORANGES, MOUNTAINS AND SURF 12

SAN DIEGO PLAYLAND 18

RECREATIONAL MAP OF CALIFORNIA 22

CALIFORNIA'S ALPS 24

AND DESERTS, TOO 30

FROM METROPOLIS TO NOSTALGIA 34

THE MOTHER LODE 40

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FRONT COVER: Top row: Mojave Desert wildflowers; Zanetta House, San Juan Bautista; Yosemite in winter; second row: Carpinteria State Beach; E Clampus Vitus initiation in ghost town of Volcano; US 395 south of Lone Pine; third row: fishing in Big Sur River; Sanctuary and Eye of God, Mission San Miguel; Sonoma Coast. John Robinson photographs.

BACK COVER: A California Beach. John Robinson photograph.

CALIFORNIA

"Listen, how I have seen
Flash of strange fires in gorge and black ravine;
Heard the sharp clang of steel that came to drain
The Mountain's golden vein—
And laughed and sang, and sang and laughed again,
Because that 'Now,' I said, 'I shall be known!
I shall not sit alone,
But reach my hands unto my sister lands!' "

By Ina Donna Coolbrith (1841–1928).
Ina Coolbrith, California's first poet laureate, came west in 1852 in the first wagon train over Beckwourth Pass, riding into California on horseback double, in front of the famous mountain man James Beckwourth.

"An outstanding network of state highways is essential to the future growth of California's economy"
—*Governor Edmund G. Brown*

TOM MYERS

S. MYERS

Northern California coast and Trinidad Head, named in 1775 by Bruno de Heecta, who took possession on Trinidad Sunday, and raised a cross on the head. In the cove behind the head is a picturesque harbor used by commercial salmon fishing fleet.

JOHN METTEPETER

Coast in the vicinity of Fort Bragg was frenetically busy when redwoods were being cut 50 years ago, and lumber schooners were working out of every "dog hole." Today it is a quiet, picturesque "land of second growth."

The Redwood Empire

PETER ASANO

Wine grape country near Healdsburg. This is also good apple country for certain varieties.

Northward from the Golden Gate to Grant's Pass in Oregon is the land known as the "Redwood Empire." Its fascination for the exploring motorist has many facets.

Famous for its spectacular redwoods, this area has much more to offer than just trees, for here are craggy coasts, fine fishing streams, many lakes for boating, and a good portion of California's fine wine country.

The main route from the Golden Gate Bridge into the Redwood Empire is US 101, a highway that extends from the Mexican border to the international waters of Puget Sound, but the portion of its length north from San Francisco to Crescent City is known as the Redwood Highway.

Just across the bridge it is a broad freeway, usually heavy with traffic moving to and from the residential cities which border its right-of-way: San Rafael, Sausalito, San Anselmo, Mill Valley, Novato, Petaluma, and half a dozen others.

As the road continues northward, it passes through the City of Santa Rosa—famous as the home of the fabulous Luther Burbank and his gardens.

Not as busy, the road wends northward

PETER ASANO

PETER ASANO

JOHN ROBINSON

PETER ASANO

To the traveler the look of the north coast is one of constantly changing mood—of old wave-cut ledges, of quiet seaside ranches, of rocky coasts being slowly battered to fragments by booming surf. On misty days the colors are muted, on sunny days they are a brilliant gold, blue, and green.

Right: Coast redwoods, Sequoia sempervirens, *and ferns, Prairie Creek Redwoods State Park. No matter how old, trees will not grow this large unless they have deep soil and cool, moist, climate. Below: Until 1963 this clump of redwoods containing the world's tallest tree was undiscovered. New champion is on privately owned land, but owner has promised to preserve trees until funds are available to create a park there.*

TOM MYERS

TOM MYERS

"Their immense trunks might be fluted columns of some noble order of architecture, . . ."

C. H. Kirkham on the redwoods

TOM MYERS

JOHN MEYERPETER

Logging is still one of California's important industries. Forests serve double purpose, both as important source of lumber and as prime recreational land.

through Cloverdale, Ukiah, and Willits, all three important lumbering centers, and the last sizable towns before Garberville, located far down the canyon of the South Fork of the Eel River.

North of Ukiah the terrain gradually becomes more mountainous, and beyond Laytonville the road climbs along a high canyon wall, then passes through a notch at Leggett and starts down a 30-mile stretch of old highway which closely follows the South Fork.

A few miles beyond Garberville the road becomes freeway again. Small patches and groves of redwoods will have been in sight for many miles, but here near Garberville in the Humboldt Redwoods State Park are seen the first really fine groves of river bottom trees, towering over 300 feet high and 12 to 14 feet in diameter.

These are the true *Sequoia sempervirens*, found only in California and in a few stands in Josephine County, just across the Oregon line.

There were once three and a half million acres of these trees, growing in great forests as far south as Monterey County. On the hills just south of the site of present-day San Francisco and in the valleys north of the Golden Gate, the land was densely covered with stands, but these were all cut early in the

state's history, primarily to furnish lumber to build the San Francisco Bay cities.

Humboldt Redwoods State Park contains about 20,000 acres, and much of its area is covered by groves of mature redwood giants. The Rockefeller Forest here is said to be the most valuable single piece of timber property in the world because of its massive trees in dense stands.

As the freeway was pushed up the Eel Canyon, the old highway was preserved and is maintained by highway crews for the use of tourists and sightseers. This is called "The Avenue of the Giants." Its World War I alignment, a narrow two lanes, winds between the great trees which crowd so close to the road in places notches were once cut to allow schoolbuses to get by.

Here are pullouts and enticing little side-roads leading to secluded picnic grounds and nature trails. At the more important points there is parking and good directional signing to help the visitor see the most interesting trees and exhibits.

Many towns border the highway between here and Eureka, the main northern coastal city—a large lumber and plywood manufacturing site, with a sizable harbor. Dairying and agriculture also are important in the surrounding area.

TOM MYERS

Surf-smelt fisherman lifts dip-net with catch of a dozen fish on Mendocino County coast. This kind of fishing is seasonal, depending on runs.

The north coast has many small harbors amidst craggy headlands and second growth redwoods where small fleets of fishing craft find refuge.

JOHN MEYERPETER

PETER ASANO

Fishing boats in Tomales Bay, Sonoma County, an important north coast commereial fishing center. Boats are deep sea trolling type.

JOHN MEYERPETER

Group of smelt fishermen working near Fort Bragg. Water is cold, and sometimes surf is dangerous.

Chapel at Fort Ross, once in ruins, has been restored. State historical park commemorates farthest Russian penetration into North America.

JOHN MEYERPETER

TOM MYERS

TOM MYERS

TOM MYERS

The picturesque location and the weathered old-fashioned structures have made Mendocino a modern haven for artists.

Eureka's developing urban complex includes Fortuna, Arcata, Loleta, Blue Lake, and half a dozen other communities. In this location are many fine modern motels and excellent restaurants.

North of Eureka the highway closely follows the magnificent northern coast for much of the way to Crescent City, a town smaller than but similar to Eureka. On this portion of the Redwood Highway are a number of excellent state parks, some of them coastal, but including Prairie Creek Redwoods and Del Norte Redwoods, also two locations with redwood groves that rival Humboldt Redwoods.

Above Crescent City US 199 becomes the Redwood Highway, and a few miles along it passes through another prime redwood preserve, Jedediah Smith State Park, with both the stream and the park named after an early explorer and intrepid mountain man.

Although the Redwood Highway is the main artery from which to explore the Redwood Empire, there are a number of other routes which take the traveler to other sections. Just north of the Golden Gate, leaving US 101 and passing through Mill Valley en route to the coast, is State Route 1, known in this area as the Shoreline Highway.

Paralleling the Redwood Highway on the west, the Shoreline Highway twists and winds for 200 miles, almost always in sight of the sea. In places it drops down almost to the sea, and then climbs again high up the flank of a headland.

Near its southern end, at Point Reyes Station, is a road connection for those who want to explore the Point Reyes National Seashore. A few miles north is Bodega Bay, where a colorful fishing fleet is harbored.

Farther north another 20 miles or so, along some of the most inspiring sections of coast on the whole route, is restored Fort Ross, once seat of Russian power in California. Here are the watchtowers, the commander's house, and the Russian Orthodox chapel, just as they were when the fort was an outpost for the Russian sea otter fur industry.

The northern portion of the Shoreline Highway passes through many small towns and villages, the wooden frame buildings bleached by the salt air and looking more like eastern seaboard settlements than California. In the Fort Bragg area are some big lumber mills, a number of fine state parks, and the beautiful fishing boat harbor at Noyo. Above Fort Bragg the road passes along an ever wilder and more picturesque coast before it turns inland at Rockport and rejoins US 101 at Leggett.

In the southern portion of the Redwood Empire there is a network of roads over which to explore the rich agricultural counties of Lake, Sonoma, and Napa. Lake County takes its name primarily from Clear Lake—largest body of fresh water completely within the

JOHN ROBINSON

Richardson Grove State Park has an excellent stand of old redwoods, as well as the Eel River for water play. Air mattresses are the vogue in summer in this placid stream, which in times of heavy winter rain can suddenly become one of the most destructive in the U.S.

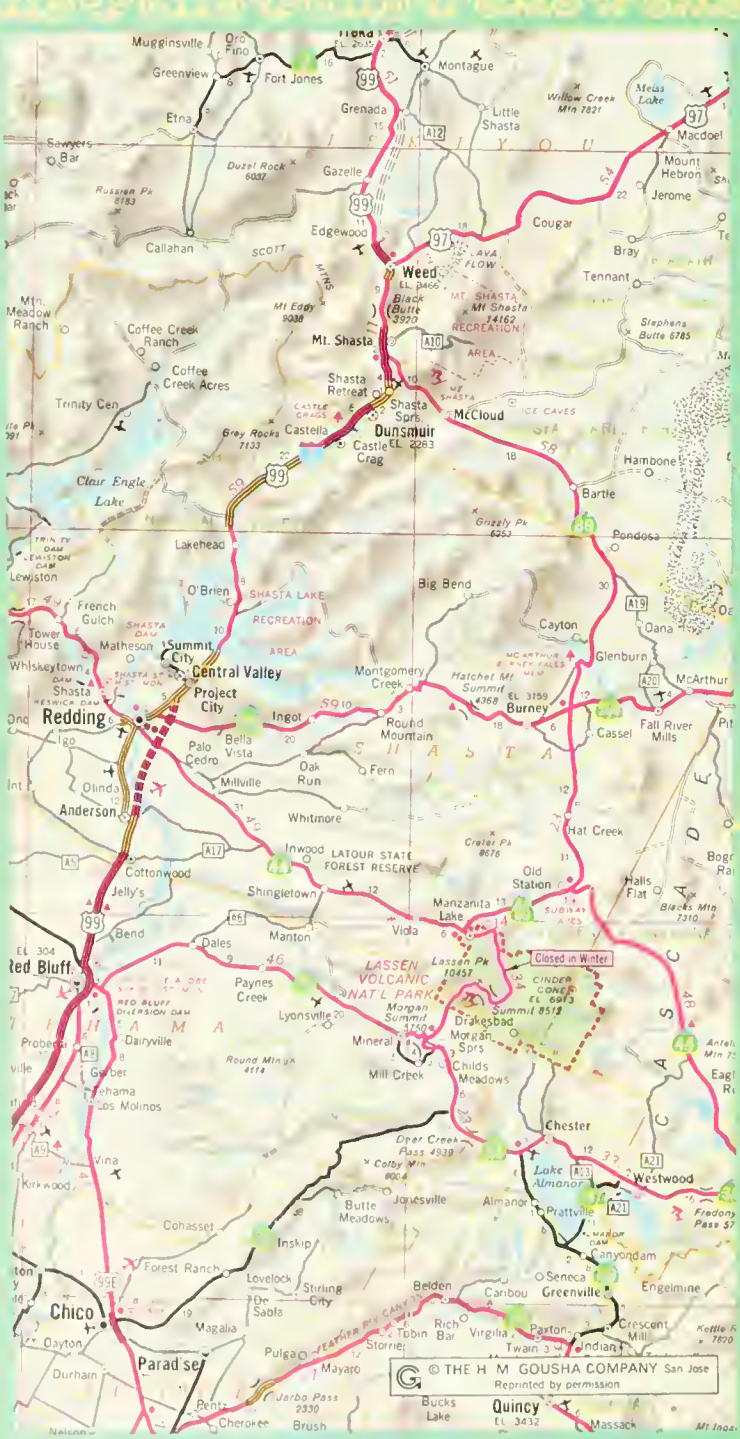
state boundaries (Tahoe is larger, but lies partly in Nevada).

In these interior counties the summer climate is warm and dry, and Clear Lake, supplemented by its associated Blue Lakes and a number of manmade reservoirs, is an outstanding water ski center. Fishing also is good at certain seasons, and resort developments line the lake's shores.

Both Napa and Sonoma Counties are famous for their wines, and the slopes of their valleys are covered with vines. Here you may arrange for special tours of the wineries, many of which are now more than a hundred years old, with interesting architecture and ancient vats brought from Europe in some cases.

In Sonoma County the town of Sonoma is rich in California history, and is one of the state's oldest settlements. Developed in the 1830's as a northern rampart against feared Russian encroachment, it was a garrison town and home of General Vallejo, one of the state's outstanding citizens, a patriarch and wealthy landowner.

With history, magnificent coastal vistas, towering mountains, and cathedral-like redwood groves, the Redwood Empire is a kaleidoscope of impressions for the visitor.



Shasta-Cascade Wonderland

Travelers looking for contrast from the bustle of metropolitan life will find a visit to the seven-county area comprising northeastern California puts them back in step with the harmony of nature. This part of the state, locally called the Shasta-Cascade Wonderland, offers countless havens for outdoor leisure, and is easily reached by state highways converging from several directions.

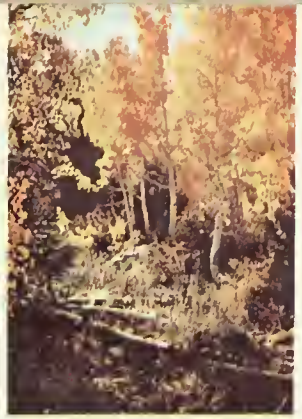
The main access route either from the north or south would be over US 99, now becoming Interstate 5 over much of its length. South of Red Bluff, 99 splits into 99E and 99W, the letters indicating "east" and "west." 99W of course is the best access route from the San Francisco Bay area, while 99E is better from Sacramento and other central valley points. Eventually, however, I-5 will swing east from 99W at Dunnigan to continue through Woodland, Sacramento, and Stockton, and southward along the eastern side of the coast range as the Westside Freeway.

About four hours away from San Francisco, somewhat less from Sacramento, lie the "gateway" cities of Red Bluff and Redding. Their locations at the base of the Trinity-Shasta-Lassen areas provide convenient departure points for treks into the wilderness—for pack trips and camping, boating, fishing, hunting, and even fossil and gem seeking.

Eastward from US 99, Route 36 leads to the southern entryway to Lassen Volcanic National Park (closed in winter). Dangerously

"As lone as God, and white
as winter moon
Mount Shasta's peak looks down . . ."

from *Mount Shasta* by William F. Burbank



JOHN MEYERPETER

The quaking aspen, Populus tremuloides, *native to widespread areas of the West, is one of the world's most showy fall-color trees.*

JOHN MEYERPETER

This is another California, with the Sierra Nevada left behind, and the Cascades penetrating all the way south from Washington. They have been a vigorously volcanic range and their mark can be seen in many places, but a generous rainfall has masked most of the scars with dense pine forests.

Large photo: Double coned Mt. Shasta dominates the area, rising over 14,000 feet. Left: Mt. Lassen, seen across Reflection Lake in winter, is the only live volcano in the United States.
Above: Chaos Crags are children of Lassen, only 200 years old.

JOHN MEYERPETER

Above and below: Joss House in Weaverville is a state historical monument, but also a bonafide Taoist temple with regular worshipers. Although building is only somewhat less than a hundred years old, its altar, imported from China during the Gold Rush, is very ancient. Bottom: Weaverville, once center for great hydraulic mines in vicinity, has unique outside spiral staircases on main street buildings.

TOM MYERS

PETER ASANO

hot steam and boiling mud still rise to the surface within the park at Bumpass Hell, Boiling Springs Lake and Devils Kitchen, and other inactive volcanoes flanking Lassen Peak are Chaos Crags, Eagle Peak and Bumpass Mountain.

Crossing through Redding is Route 299, the major east-west highway in northern California, giving access into the Trinity Alps Wilderness Area—one of the most rugged parts of California north of the Sierra Nevada. High jagged peaks and deep-cut valleys carved by glaciers are special delights to backpackers.

Trails are good and distinctly marked and the experienced wilderness lover can blaze his own trails to several of the remotest lakes for fishing. Arrangements for trips with licensed packers can be made.

There are several dams with large reservoirs in the vicinity. Trinity Dam and the smaller Lewiston Dam harness the Trinity River. Beyond is Clair Engle Lake, recently renamed to honor the late United States senator from California. It, like almost all lakes in northern California, is a recreational paradise with 145 miles of shoreline backed by pine-clad slopes.

A third dam (dedicated by the late President John F. Kennedy in 1963) is located eight miles west of Redding on Route 299. This dam creates Whiskeytown Lake, with its surrounding area operated by the National Park Service.

Back on Interstate 5/US 99 beyond Redding, this major highway to Portland passes over massive Shasta Lake via the Pit River Bridge, the tallest double deck span in the world. With 365 miles of shoreline, Shasta Lake has many coves, bays and arms, and its shape is sometimes compared to a maple leaf. The topography of this body of water and its surrounding shores facilitates finding relatively private campgrounds and picnic areas. The lake abounds with fish: Seventeen varieties, from sturgeon to blue gills, lurk in the lake waters, so every fisherman, from novice to expert, has a chance to enjoy his version of the sport.

Shasta Dam makes the Sacramento River a stable stream all the way from the San Francisco Bay area to Redding, and increasing numbers of wilderness seekers use their boats as primary transportation to the north counties area. The steady release of cold, clear water has made the river an angler's treat. Throughout the year, there are three distinct salmon migrations.

Northern "gateway" cities to the Shasta-Cascade Wonderland are Yreka, Weed, and Dunsmuir, all located on Interstate 5/US 99. Yreka is the closest California city to Iron Gate Reservoir and Dam on the Klamath River, only a few miles from the Oregon border, and well-known for steelhead and salmon fishing.

The river flows through the Marble Mountain Wilderness Area, where many trails branch

JOHN ROBINSON

Two photos on left are on Bumpass Hell nature trail, near summit, Mount Lassen Volcanic National Park. A container at beginning of trail furnishes leaflet as key to numbered markers like one near boy in center photo. Right photo is of Burney Falls, one of scenic high points in Shasta area, and located in a sizable state park.

A PLACE FOR HIKING, FOR FISHING, FOR TOURING, FOR CAMPING

toward lakes loaded with trout but seldom fished because of their remoteness. No machinery or vehicles are allowed in the wilderness area, and horsemen and back packers are rewarded with unmarred beauty. Klamath National Forest, covering many acres, is one of the greatest timber reserves in the United States. Most of the timber land is available for exploration and recreational use.

East of Weed, there is abundant evidence of volcanic action. Three areas of lava flow in addition to the Lava Beds National Monument are located within Siskiyou and Modoc Counties. Lore on the Modoc War, where about 80 Modocs confounded sizable units of the U.S. Army, is carefully preserved at the Lava Beds National Monument.

Between Weed and Dunsmuir lies the town of Mount Shasta and Siskiyou County's most widely known landmark, 14,162-foot-tall Mt. Shasta. This extinct glacier-carved volcano can be seen for more than 100 miles in each direction. Rising Alp-like from the valley floor, it harbors a popular ski resort with terrain to accommodate both beginner and expert.

South of the lava beds, and near the junction of Routes 89 and 299, McArthur-Burney Falls State Park has extensive picnic facilities and large public camping grounds. Center of interest in the park is Burney Falls—a spectacular split waterfall fed by an underground river which surfaces less than a quarter-mile upstream.

This is all part of the Shasta-Cascade Wonderland—a land superbly suited to the outdoorsman.

PETER ASANO

Fisherman is working Trinity River near Junction City. Highway 299 passes across background in picture.

TOM MYERS

Limit catch of trout taken from upper Sacramento River.

Santa Barbara
Ventura
Oxnard
Port Hueneme
Santa Paula
Fillmore
Piru
Moorpark
Simi
Thousand Oaks
Camarillo
El Rio
Saticoy
Bardsdale
Somis
Newbury Pk
Hidden Hills
Santa Susana
Newhall
Saugus
San Fernando
Chatsworth
Canoga Park
Sunland
Tujunga
Topanga
Malibu
Topanga Beach
Malibu Vista
Santa Monica
Los Angeles
Beverly Hills
Hollywood
Venice
Culver City
Inglewood
El Segundo
Manhattan Beach
Hermosa Beach
Redondo Beach
Palos Verdes Pt
Torrance
San Pedro
Long Beach
Seal Beach
Sunset Beach
Huntington Beach
Newport Beach
Balboa
Corona del Mar
Laguna Beach
South Laguna
Three Arches
Dana Point
Capistrano Beach
San Clemente
Avalon
SANTA CATALINA ISLAND
SANTA CRUZ ISLAND
SANTA ROSA ISLAND
SAN MIGUEL ISLAND
ANACAPA ISLAND
Santa Barbara Channel
Santa Cruz Channel
San Miguel Passage
Anacapa Passage
Santa Monica Bay
San Pedro Channel
Outer Santa Barbara
PACIFIC OCEAN
Burbank
Glendale
Pasadena
Arcadia
Monrovia
Alhambra
Azusa
Glendora
San Dimas
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Murrieta
Wildomar
Lake Elsinore
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Warm Springs
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Lancaster
Palmdale
Rosamond
Mojave
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Willow Springs
Fairmont
Edwards
Acton
Vincent
Ravenna
Solemint
Honby
The Oaks
Harold
Wilsona
Littlerock
Pearblossom
Llano
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Sandberg
Three Points
Gorman
Lebec
Tejon Pass
Caswell
Alamo Mtn
Pine Mtn Summit
Oak Creek Canyon Summit
Matilija Spgs
Meiners Oaks
Wheeler Springs
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Emma Wood Beach
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Mt Wilson
Mt Baldy
Mt San Antonio (Old Baldy)
Big Pines
Wrightwood
Mt Gleason
Lytle Creek
Keenbrook
Devore
Rancho Cucamonga
Ontario Int'l Airport
Chino Airport
Riverside Municipal Airport
March AFB
Edwards AFB
Naval Weapons Center
Naval Air Facility
Naval Amphibious Base
Fort MacArthur
Camp Pendleton
Los Angeles Int'l Airport
Long Beach Municipal Airport
Orange County Airport
Santa Ana Army Air Base
Los Alamitos Naval Air Station
Los Alamitos Army Air Base
Hawthorne Municipal Airport
Torrance Municipal Airport
Compton
Lynwood
Downey
Whittier
Norwalk
La Habra
Brea
Fullerton
Anaheim
Yorba Linda
Buena Pk
Garden Gr
Orange
Tustin
Santa Ana
Costa Mesa
Irvine
Silverado
Modjeska
Glen Ivy Hot Spgs
El Toro
San Juan Capistrano
San Juan Hot Spgs
Sun City
Romoland
Menifee
Winchester
Homeland
Nuevo
Green River
Corona Airport
Elsinore Airport
Hemet-Ryan Airport
Skyhaven Airport
Temecula Airport
Agua Caliente Indian Reservation
Pala Indian Reservation
Rincon Indian Reservation
Santa Ysabel Indian Reservation
Cahuilla Indian Reservation
Morongo Indian Reservation
Soboba Indian Reservation
Pechanga Indian Reservation
Los Coyotes Indian Reservation
Santa Rosa Indian Reservation
Twenty-Nine Palms Indian Reservation
Torres-Martinez Indian Reservation
Cabazon Indian Reservation
Augustine Indian Reservation
Cahuilla Indian Reservation
Mission Indian Reservation
Mission Indian Reservation
Mission

". . . la ereccion de un pueblo
con el titulo de Reina de Los Angeles
sobre el rio de la Porciuncula . . ."

from a provincial state paper dated December 27, 1779.

Oranges, Mountains & Surf

Panoramic view of Hollywood Bowl during evening concert, city in background.

OTTO ROTHSCHILD

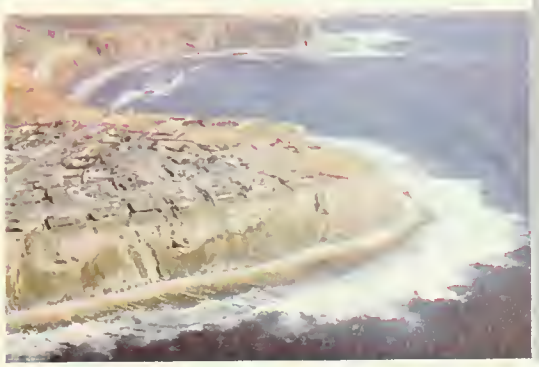
In the days of Richard Henry Dana, when he was collecting hides and experience for his classic *Two Years Before the Mast*, Los Angeles was a small village of adobe houses with reed roofs caulked with tar from the local pits. In the 125 years since, it has grown to a spreading urban complex covering hundreds of square miles of the Los Angeles lowland. The city itself is only a relatively small portion of this great sprawling metropolis which takes in dozens of sizable cities, but to the average visitor it is all "Los Angeles."

Today this complex of cities is by far the state's most important urban area, and a great world center. Because motion pictures and TV touch the lives of so many people, it has gained great renown in these fields, but it also has beaches, mountains, historical landmarks, art museums, and galleries.

It has the corner of Hollywood and Vine, and the best in restaurants and night spots. The Mount Wilson Observatory and the Griffith Park Observatory attract hundreds of thou-

JOHN MEYERPETER

Los Angeles has a sizable Chinatown, with many good restaurants.



At Portuguese Bend, the expanding city comes to an abrupt stop when it meets the sea.

Six photos above show portions of Los Angeles freeway system. Left to right they are: Vincent Thomas Suspension Bridge and below it the Harbor Freeway which connects to it. Next is view of San Diego Freeway over Sepulveda Pass, and below it a view of the same freeway a few miles south with interchange with Santa Moniea Freeway under construction. Next right is high-altitude photo of downtown Los Angeles with four freeways converging on the four-level interchange, and below it a closer view of the interchange.

sands of visitors a year. There is a bustling harbor a few miles away at Wilmington and San Pedro. The world's finest network of freeways crisscrosses the area, putting everything within easy driving distance.

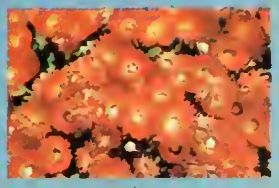
Evidence of the city's heritage are the Chinese, Japanese and Mexican "little towns" that dot the city center. In each is caught the flavor of another culture that has richly endowed the area. Fine restaurants and curio shops draw residents and visitors alike.

The Coliseum, built for the 1932 Olympic games, is just off the Harbor Freeway. Visited by nearly 2,000,000 persons a year, it seats 100,000 spectators and is the scene of innumerable sporting events, carnivals and religious gatherings.

Nearby is the Sports Arena, where ice hockey and basketball games are played on regular schedules. It also is used for occasional stage shows, exhibits and other special events.

Paleontologists are fascinated by the La Brea Tar Pits, where mammals, birds, reptiles and amphibians trapped in the sticky material many millions of years ago create today an almost inexhaustible source of fossils for scientific research. In scenic Hancock Park on Wilshire Boulevard, adjacent to the tar pits, stands

Top of page is aerial view of Exposition Park with Los Angeles Colosseum and Sports Arena. Above: The new Los Angeles Music Center.



JOHN MEYERPETER

he magnificent new County Art Museum, hich houses art objects worth more than 32 illion dollars.

The latest addition to the city's cultural fa- ilities is the imposing downtown Music Center t one end of a landscaped mall on which faces he city hall and other governmental buildings. Nestled in the foothills off Hollywood Free- ay is the Hollywood Bowl, where about 00,000 persons a year listen to music programs ich as "Symphony Under the Stars."

Most travelers don't consider a visit to Los ngeles complete without having taken at east a look at portions of two major streets— he Wilshire Miracle Mile and the Sunset Strip. nd nobody leaves town without having natched his footprints with those of the stars n the sidewalk at the entrance to Grauman's hinese Theater.

South of the city on Interstate 5 is Mission an Juan Capistrano, famous for its swallows, nd north from here another highway, State oute 1, continues along the littoral through aguna Beach. Artists put it on the map; today oneymooners enjoy its romantic atmosphere.

Just a few minutes farther up the coast, the oad passes through Newport Beach and Bal- oa, famed the world over for their sailing and

TOM MYERS

Southern California has many miles of coastline suitable for beach play.

Kite skiing, in which skiier actually lifts off water, is sport for experts.

TOM MYERS

The development of the fiberglass board has greatly advanced surfing in California.

yachting facilities. Nearby are beaches popular with the sun and swim set.

Long Beach, 100 miles up the coast from San Diego, and 20 miles south of Los Angeles, became a city almost overnight when the great Signal Hill oil field was discovered. With a population today of nearly 400,000, it is the largest city in the Los Angeles lowland after Los Angeles itself. Oil has remained an important industry, and in recent years it has become a tourist city also, with seven miles of public beaches, good restaurants, and plenty of accommodations.

Long Beach, in partnership with San Pedro, is the traditional base for the U.S. Pacific Fleet, although the carriers and the majority of the smaller units are based in San Diego. San Pedro is the largest commercial fishing port in the world, and from both there and Long Beach sport fishing boats make regular trips outside the harbor. In this area also, surface and air transportation to Catalina Island is available.

Via Santa Monica, Malibu and other beachfront communities, Highway 1 hooks up with US 101 north of Oxnard. A few miles farther north is Mission San Buenaventura, founded in 1782 by Fray Junípero Serra, the ninth mission to be established along El Camino Real.

The City of Ventura, center of a booming county that combines agriculture with modern business, has a Pioneer Museum with a collection of Spanish and pioneer-day relics, and a California Oil Museum housing ancient equipment and rare maps used during the early days of the oil boom. Fine fishing, sheltered coves and mysterious grottos are among the attractions of Ventura's 60-mile shoreline.

Thirty miles up the coast, after rounding Point Rincon—a favorite surfing spot—motorists come to the City of Santa Barbara, filled with southern California nostalgia, but also a modern city with fine accommodations and restaurants.

This is a city with much history, and it has preserved a great deal of its heritage. Of special interest are the old mission, the Historical Museum, built of native adobe, the Pueblo Viejo, Santa Barbara's old town section, and the world-famous courthouse built in Spanish-Moorish architecture.

Stearns Wharf boasts restaurants, novelty shops and sport fishing charter boats. The yacht harbor is haven for some 600 pleasure craft of all sizes and shapes.

Having turned its back on industry that makes noise and smoke, Santa Barbara today is home of a number of research and development firms that produce nothing but ideas. Ten miles west, by the airport, is the University of California at Santa Barbara, the most beautiful of the university's campuses.

Leaving Santa Barbara on his northward journey, the traveler has the choice of continuing along US 101 or taking Highway 154

JOHN MEYERPETER

TOM MYERS

Although generally similar, each of the 21 missions has its own architecture. Bell tower above is at La Purisima. Left: The mission at Santa Barbara has continued as an active church since it was first dedicated. Men in dress suits on steps are ushers waiting for their wedding party.

JOHN ROBINSON

over San Marcos Pass and into fertile Santa Ynez Valley with its Lake Cachuma. On Route 154 he will be sure to visit Solvang, the quaint Danish community where thatched roofs and Scandinavian souvenirs meet the eye. Not far beyond, the road rejoins US 101. Northbound autoists leave Santa Barbara County through Santa Maria, a thriving city that serves as the marketplace for the rich agricultural area that surrounds it.

Before leaving the county, visitors may wish to swing west toward Lompoc to visit the superbly reconstructed Mission La Purísima Concepción, with buildings and grounds rebuilt to match as closely as possible the originals which existed when the establishment of the padres was the center of civilization for the entire district.

This is glamorous southern California, the land of the Spanish dons and the Mexican influence—and Hollywood. The many reminders of its history are seen today against a background of bustling cities, towering mountains, and long sandy beaches with foaming surf.

TOM MYERS

Visitor guides at Santa Barbara Mission are Franciscan padres.

ROBERT ROSE

ROBERT ROSE

Above and left: Mission San Luis Rey de Francia, near Oceanside, is one of the most beautiful in the chain. Founded by Father Lasuen in 1798, it is a composite of Spanish, Moorish, and Mexican architecture.

San Diego Playland

"Discovered a port enclosed and very good"

Juan Rodriguez Cabrillo, 1542.

South from Los Angeles the traveler moves into true subtropical country. The high mountains are back from the sea, and the main north-south recreational route, US 101, travels much of the way within sight of the blue Pacific.

The state's travel map shows an almost continuous series of little stylized pine trees along this coast, each indicating a state park. These are primarily parks for the casual visitor—day use areas mainly—where picnicking, surfing, swimming, and sunbathing are main attractions. But the road's appeal is primarily visual, passing through a series of sparkling coastal towns and cities, with frequent vistas of blue water, white surf, and an occasional craggy headland.

Although the new Interstate 5 will pass a few miles inland, the older 101 route stays near the sea until it climbs the grade at Torrey Pines State Park—one of the most important of the southern California parks because of its scenic reserve. Here is preserved the last native stand of the picturesque pine for which the park is named—about 2,500 trees in all.

South of Torrey Pines is La Jolla, with its

Above: San Diego County has 10 state beach parks, and also several more locally operated beaches. Below: "Old Spanish Lighthouse," a national monument, is a misnomer, as structure was built in 1850's after California became a state. From lighthouse on Point Loma can be seen nearby Ballast Point, where Cabrillo is said to have landed in 1542. Wildflowers are native coreopsis.

JOHN ROBINSON

JOHN ROBINSON

San Diego skyline and Coronado Ferry.

GEORGE LANGSNER

JOHN ROBINSON

Navy's North Island from Coronado Ferry landing.

JOHN ROBINSON

Victorian era Hotel del Coronado offers opulence of an earlier day.

beautiful homes, its Scripps Institution of Oceanography, its beaches and The Cove. The Scripps Institution is open daily to visistors who wish to see the marine museum and the aquarium.

But although originally US 101 passed through La Jolla, today it drops down Rose Canyon, and comes into San Diego proper across the bed of the San Diego River, close to the part of the city which was first settled, locally known as "Old Town." Here the presidio was established in 1769, and still existing are many old adobe homes.

San Diego is California's oldest city. Its site was claimed for Spain in 1542 by Admiral Juan Rodríguez Cabrillo, a Portuguese navigator who first came to the new world as a crossbowman with Cortés.

Occupied with the Manila trade, the Spaniards neglected California until 1602, when Don Sebastián Vizcaíno, one of the most famous of the west coast explorers, sailed from Acapulco in his flagship *San Diego*, accompanied by the ship *Santo Tomás* and the frigate *Tres Reyes*. November 10 found them anchored off Los Guijarros (Ballast Point) in the shadow of Point Loma.

Vizcaíno and his party, like Cabrillo, were delighted with the harbor, pronouncing it probably "the best to be found in all the South Sea." Vizcaíno named the port and its future city after the canon San Diego de Alcalá, whose feast day came two days after they arrived.

By 1850, the town had grown to a metropolis of more than 500 foreigners, 10 stores and 88 houses, and some 2,000 Indians. It did a smattering of trade, but it was primarily a hide-collecting center and base for whalers.

Today San Diego is a great seaport, a vital naval base, an important training center for sailors and marines, and an aircraft manufacturing center. It also is developing a diversity of small industries.

But perhaps in the long run San Diego's greatest industry is tourism. It is a beautiful city, and it has made the most of its natural features.

When it was necessary to dredge the harbor channel so large aircraft carriers could be accommodated, San Diegans had the mud piled up on a shoal along the edge of the channel, and today Shelter Island is one of the city's showplaces. It is a yacht harbor, boating center, and a long parkway lined with fine restaurants and exotic motels from which guests can watch the harbor entrance traffic through palm trees rustling in the sea wind.

North of the headland which makes Point Loma, the delta of the San Diego River was once a huge mud flat, with shallow lagoons and channels. This, too, has been dredged to make channels and lagoons for boats, with islands and peninsulas thrusting into the water. Here too are exotic restaurants and motels, and thousands of transplanted palm trees, fine

Upper left: Towers of 1915 Exposition furnish architectural richness to San Diego's Balboa Park. Above: Famous San Diego Zoo celebrates its 50th anniversary this year. Below: Crowd watches antics of inmates of one of primate exhibits at zoo.

lawns, and paved parkways.

The Old Spanish Lighthouse on Point Loma, preserved as a national historical monument, is one of the most heavily visited such sites in the United States.

One of the state's finest ocean beaches is preserved at Silver Strand State Park, on the long sandy strand which closes off the inner harbor from the sea. Ocean Beach, Mission Beach, and La Jolla have fine beaches, also.

Perhaps the finest feature of the city is Balboa Park, once set aside as a recreational area "on the outskirts of town" but now completely surrounded by the city. Many of its buildings and its beautiful bridge date back to the Panama-California Exposition of 1915–16. More buildings were added during the 1935–36 California Pacific International Exposition. The city has added still others, and there are fascinating museums, theaters, and art galleries. The matured plantings of trees and shrubs give the park an unbelievable lushness close to the towering skyscrapers of downtown San Diego.

In Balboa Park is San Diego's world-renowned zoo, one of the first to embrace the modern concept of natural-looking animal enclosures rather than iron cages. This year the zoo is celebrating its 50th anniversary, but it refuses to accept old age and is still growing, with sizable additions under construction.

Another asset is the harbor. There are docks, wharves and great oceangoing vessels enough to satisfy the desires of even the most frustrated would-be deep-water sailor, and there is also a host of Navy ships. Excursion boats leave on regular schedules to take visitors on tours of the harbor.

South of town a score or so of miles away is the Mexican border and the International Gate at Tijuana. Americans are allowed to come and go freely here on short-term visits, and much of Tijuana's prosperity can be traced to the free-spending Yankee. Here the visitor can tread foreign soil, buy souvenirs and gifts, or sample the cabarets.

Primarily considered a winter resort, San Diego would like to be thought of as a place to visit all year round.

Recreational Map of California

Legend

State Scenic Highway System—Master Plan

Connecting Highways Under Federal Jurisdiction

State Highways—Existing

State Highways—Unconstructed

State Beaches, Parks, and Recreation Areas

National Parks and Monuments

JOHN ROBINSON

JOHN MEYERPETER

Above right: Snow plant (Sarcodes sanguinea) *is protected by California law. Above left: Convict Lake, a typical mountain lake of the subalpine zone in the southern Sierra. Below: Long Lake, altitude about 6,000 feet, one of hundreds of such lakes in northern Sierra.*

JOHN ROBINSON

Reno
Carson City
Lake Tahoe
YOSEMITE NATIONAL PARK
KINGS CANYON NATIONAL PARK
Bishop
Independence
Mammoth Lakes
Mono Lake
Bridgeport
Bodie (Ghost Town)
Yosemite Village
Tuolumne Meadows
Glacier Point
Mt Lyell 13114
Mt Ritter 13157
Mt Whitney 14495
Mt Williamson 14375
Mt Tom 14240
Mt Langley 14042
Mt Pinchot 13491
Mt Humphreys 13986
Mt Morgan 13748
Mt Darwin 13830
Mt Patterson 11673
Mt Ross 8633
Mt Rose 10776
Mt Lola 9148
Mt Judah 9148
Mt Tallac 9735
Mt Price 9982
Mt Stanford 11973
Mt Goddard 13568
Mt Gabb 13747
Mt Hilgard 12378
Mt Dade 12600
Mt Abbot 13715
Mt Hoffman 10850
Mt Dana 13050
Mt Gibbs 12764
Mt Conness 12590
Mt Lyell 13114
Mt Ritter 13157
Mt Banner 12945
Mt Clark 12451
Mt Starr King 9092
Mt Broderick 9524

JOHN ROBINSON

Left: Skiers at Badger Pass winter sports area, Yosemite National Park.

TOM MYERS

"and far beyond, like clouds upon the border of the sky,
towered minarets of white, where the Sierra's eternal snows
flashed austerely the blazes of the sun."

Jack London in *All Gold Canyon*

California's Alps

Blue water, green trees, and a speeding boat create adequate sport for many Californians.

JOHN ROBINSON

The Sierra Nevada, California's most dominant mountain range, is more than 400 miles of granite wall which shuts most of the state off from its neighbors on the east. It provides much of the state's water from its snowpack, and its towering bulk acts as a climate control to keep the cold continental air out of the great Central Valley.

Within its length are three national parks—Sequoia, Kings Canyon, and Yosemite—and nearly a dozen fine state parks as well. Its highest peak is Mount Whitney which rises 14,496 feet above sea level—highest in the continental United States—but it has dozens of peaks over 12,000 feet.

The Sierra is a solid block of granite, its western edge buried beneath the alluvial deposits of the Central Valley, its eastern edge upraised along a great series of faults which

JOHN ROBINSON

JOHN ROBINSON

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Top: Upper Sardine Lake, in Lakes Basin country, northern Sierra. Top right: Emerald Bay and Lake Tahoe. Right: One of the Inyo Craters in vicinity of Mammoth Lakes. Bottom: Sierra scene reminiscent of Maxfield Parrish, famous American landscape painter who died this year.

JOHN MEYERPEETER

run roughly on a northwest-southeast axis. Because of this overall tilt, drainage is toward the west, and a score of rivers have cut deep, roughly parallel canyons. The drainage collects in the Central Valley, flowing northward in the San Joaquin River, and southward in the Sacramento, to finally reach the sea through San Francisco Bay and the Golden Gate.

Although a few streams drain down the eastern scarp, and have cut respectable canyons, most of the scenic beauty on that side has been created by glaciers, particularly in the more elevated southern portion.

Of course, many of the westward-flowing streams run partially in glacially carved canyons, also. The most spectacular of these is the Merced through Yosemite Valley.

A relatively "young" range, and not yet greatly worn down by erosion, the Sierra Nevada provides outstanding scenery. It has, in fact, been called the American Alps because of its many peaks and sharply serrated ridges. Portions of the Rocky Mountains are as high as the Sierra Nevada, but the Sierra's long slope rises steeply virtually from sea level, whereas some of the spectacular quality of the rockies is lost because they are approached over a gently rising plateau.

Peaks at the southern end of the Sierra average four to five thousand feet higher than those at the northern end. Consequently, the southern end is not only more rugged, but the passes are much higher. For more than 150 miles of this part of the range—between Tioga and Walker passes—there are no roads across the summit at all. Furthermore, the four highest passes—from Tioga's 10,000 feet to Carson's 8,600 feet—may be closed by snow sometimes as early as September and stay closed until May or June. Hence, much of the year, more than 200 miles of the Sierra cannot be crossed, except on skis or snowshoes!

To the summer traveler in California this is not important, but it is important to know

JOHN ROBINSON

Above left: State Route 120 enters Yosemite National Park from east via Tioga Pass. Above: Cathedral Rocks, Yosemite National Park, in winter.

there is no single road which traverses the length of the Sierra. To reach various parts of this range you must use one or the other of two main north-south arteries—either US 99 in the Central Valley or US 395 along the east side (see story on deserts). From either of these routes you can turn off on any of a dozen highways which penetrate the high Sierra.

Highway 49, the Mother Lode route (see Gold Country story), generally parallels US 99 in the foothills of the central and southern Sierra. It offers a chance to combine two sightseeing trips in one, although it is a slower route than 99.

Most of the state routes cross from 99 to 395, and all are scenic. One of these, State Route 88, was awarded best in the United States for 1965 in the *Parade Magazine* scenic highway contest, but most of the others have as much to offer in the way of canyons, streams, lakes, and high country.

Two federal-aid routes, Interstate 80 and US 50, cross the northern Sierra in the vicinity of Lake Tahoe. One of the world's most beautiful bodies of water, it is also one of the highest sizable lakes in the world, and larger than any others in California. US 50 passes around the southern end of the lake, while two routes from Truckee reach the northern end. One of these, State Route 89, passes the entrance to Squaw Valley, site of the 1960 winter Olympics, and operated as an all-year park. For skiers, it currently offers 20 lifts of various types, with more planned. It has many summer attractions, also, including the tramway, which operates year round to carry visitors to Squaw Peak for an exciting view of the scenic valley.

Of the national parks in the Sierra, Yosemite is the most famous, with its sublime valley known throughout the world. This is no doubt the most exciting glacially carved landscape in the world. Not to be overlooked are the fine groves of Sierra Big Trees and the high

JOHN ROBINSON

Winters in the California mountain communities can be hard, and because of this a different kind of architecture has evolved—a sort of marriage between eastern and Gold Rush styles.

JOHN MEYERPETER

The east side of the Sierra Nevada in winter is a sight unknown even to many Californians.

JOHN MEYERPETER

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JOHN MEYERPETER

Above: Aspens in autumn at Crowley Lake south of Lee Vining. Right above: Winter scene near Crowley Lake. Right: Sierra in the vicinity of Bishop.

country to the east of the main valley.

Sequoia and Kings Canyon National Parks are near the southern end of the Sierra. They have fine high mountain scenery and sequoias, but are also good gateways to high country pack trips.

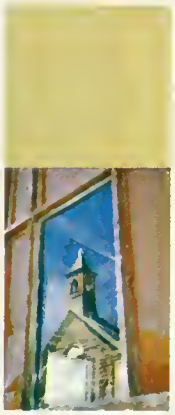
In the northern end of the Sierra, which stops abruptly just south of Mount Lassen Volcanic National Park, the major route is State 70. This superbly engineered route up the famous Feather River Canyon gives access to the lower northern summits. Although not as spectacular as the southern end of the range, the mountains here are well wooded and watered, with hundreds of lakes and streams, and this is good family vacation country. There are several other highways besides 70 which penetrate it.

No exploration of California is complete without a trip down the east side of the Sierra on US 395, particularly from about Lake Topaz on the Nevada-California state line to south of Lone Pine. This is the uplifted eastern edge of the range, and the towering peaks make the highway and its cars look insignificant and puny. In early autumn the aspens blaze in golden patches in contrast to the deep blue skies, and the lakes sparkle in the sunshine.

At Bishop you may find a motel room with the Sierra visible out your front window, the White Mountains at the back. At Lone Pine is Mount Whitney and Whitney Portal, and the strangely beautiful Alabama Hills, scene of thousands of movie and TV westerns.

There are several ways to enjoy the Sierra. You can explore it with your car, drinking in constantly changing visual impressions. You can make a more leisurely visit, taking some of the enticing side trips, and camping or lodging as you wish. Then there is the way of the real Sierra aficionado, who hies forth with pack, on foot or on horseback, into the high country, to leave civilization behind for a few days, a week, or a month.

JOHN MEYERPETER



TOM MYERS

JOHN MEYERPETER

Top: Sierra south of Lone Pine. Small photo: Ghost town of Bodie. Next two photos: Typical Sierra scenes. Right: Mount Whitney, highest U.S. peak outside Alaska.

"Then it seemed to me that the Sierra should be called, not the Nevada or Snowy Range, but the Range of Light."

John Muir

WILLIAM CHANEY

JOHN MEYERPETER

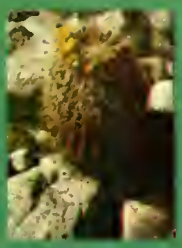
WILLIAM CHANEY

JOHN MEYERPETER

Once dreaded when transportation was difficult, the desert today is enjoyed by Californians as a great empty land with infinite variety and exotic beauty.

"For all the toll the desert takes of a man it gives compensations, deep breath, deep sleep, and the communion of the stars."

Mary Austin in *Land of Little Rain*



And Deserts, too

JOHN MEYERPETER

California's deserts, a part of the great band of middle-latitude arid lands which virtually encircle the earth, are a portion of the larger western desert complex which extends through several states. In California they are known as the Colorado Desert and the Mojave Desert. They fit the established definition of a desert as an area of extremely low rainfall which is seasonally irregular, with very hot summers and steady, drying winds.

The Colorado Desert lies west of the lower Colorado River and continues across the great Salton depression to the mountains on the far side, the Gulf of California more or less bounding it on the south. It is separated on the north from the larger Mojave Desert by a series of mountain ranges. With water from the Colorado River, great tracts of this land have been reclaimed from the mesquite and creosote bush which covered it, and they now are intensively farmed as the "Imperial Valley greenhouse."

The Mojave Desert, to the north, is larger than the Colorado and, with few sources of water, still has not come under the control of man to any great extent. It does have several

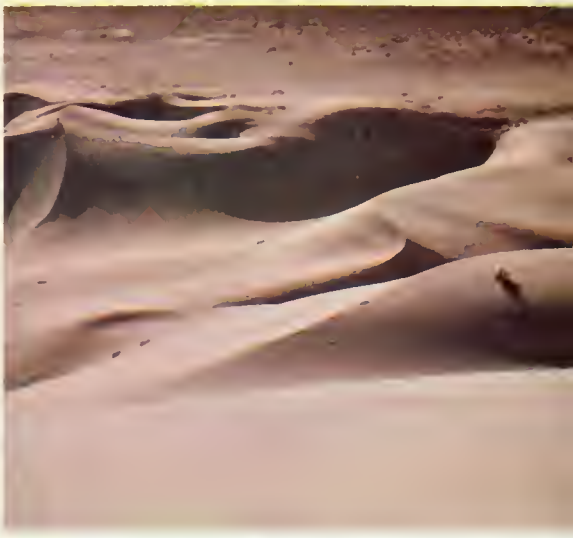
JOHN MEYERPETER

In the land of little rain, a rainbow is a rare and ethereal thing.

When a little rain does fall, wildflowers appear as though by magic in unexpected places.

JOHN MEYERPETER

JOHN MEYERPETER



JOHN MEYERPETER

In contrast to more typical photos on previous pages, views here are of some of the desert's most desolate beauty. Upper left and lower right: Split Mountain area, Anza-Borrego State Park. Upper right: Eureka Sand Dunes, near Death Valley National Monument. Lower left: Red Rock Canyon, northwest edge of Mojave Desert.

fine highways across it, however, including Interstate 15, which connects the Los Angeles area to Las Vegas and points east, as well as Interstate 40, which branches off I-15 at the growing desert city of Barstow, and continues to Needles at the state line.

Two other transcontinental routes cross the Colorado Desert. Interstate 10 connects Blythe at the state line with the Los Angeles metropolitan area. Interstate 8 runs from Yuma on the Colorado River, closely paralleling the international border and eventually terminating at San Diego.

The best north-south highway from which to see all the California desert country is US 395, the "Three Flags Highway," which extends from Canada to Mexico, and in California passes for hundreds of miles beneath the magnificent eastern scarp of the Sierra Nevada. Many side roads branch off 395, and at San Bernardino half a dozen routes fan out over the desert to offer the traveler a choice of several directions.

Long before reaching the Mojave Desert, travelers encounter true desert country. To the geologist this is "range and basin" country —a land of many geologic faults which create a widespread pattern of mountains and subsided areas between.

Although this country may occasionally get violent thunderstorms which turn dry washes

into raging rivers, greatly inconveniencing luckless campers established in them, it is generally a land of little rain. The towering Sierra Nevada peaks have wrung virtually all the moisture from the clouds before they get there.

Somewhat south of Bishop, on US 395, is the transition from mere arid country to true desert, although the change will not be apparent to the casual visitor. About 60 miles south of Bishop, at Lone Pine, is a road turning west which leads to Whitney Portal—gateway to trails climbing Mount Whitney, highest point in the United States. From its summit, 14,495 feet above sea level, if the Panamint Range were not in the way, the hardy alpinist could look down into Death Valley and the lowest point in the United States, 282 feet below sea level.

Death Valley National Monument, of course, is world famous. One of the great rift valleys, with picturesque high mountains on either side, it is full of strange natural phenomena and weird but colorful scenery.

Much farther south is the state's superb Anza-Borrego State Park, accessible by Route 78 either from the Colorado Desert or San Diego. About half a million acres of untouched primeval desert has been set aside for preservation. At camp headquarters at Borrego Springs there is a sizable campground, but dry camping is permitted in much of the area. Anza has mountains to 5,000 feet, secluded canyons, and a wide range of desert flora and fauna.

Salton Sea has become a very popular resort area, and even gets heavy use during the summer months, despite the heat. The water is warm and brackish, but waterskiiers use the sea in droves. In recent years a number of vacation communities have developed along the lake's shores.

Palm Springs, at the foot of Mount San Jacinto, is now a fabled winter resort. Here the recently built tramway takes you from the desert floor to cool, pine-clad mountains in 20 minutes.

Due north of the Salton Sea is another great expanse of desert set aside for public use—Joshua Tree National Monument. This is also a good camping, picnicking, and hiking area, with excellent scenery and fine desert vegetation.

The Colorado River forms many miles of California's eastern boundary, and hence passes through both the Mojave and Colorado Deserts. With the warm, dry climate, the river is intensively used for boating and fishing. In the spectacular badlands through which the stream flows, camping and hunting are popular with desert-wise people.

With today's good roads, the desert is no longer a place to be feared, but a spacious winter playland for all to enjoy.

JOHN MEYERPETER

JOHN ROBINSON

JOHN ROBINSON

JOHN ROBINSON

These photos were all made in one small area of the eastern Mojave Desert plateau, at about 2,000–3,000 feet altitude. Their wide variation in color and form gives hint of the infinite variety to be found in desert wildflowers. Several are desert forms of familiar wildflowers such as Indian paintbrush at upper right; and yellow poppy at lower right, which is closely related to California State Flower.

San Francisco
Oakland
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Santa Rosa
Petaluma
Napa
Vacaliville
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Vallejo
Concord
Walnut Creek
Pittsburg
Antioch
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Redwood City
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Mountain View
Sunnyvale
Santa Clara
Milpitas
Campbell
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Santa Cruz
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Gilroy
Hollister
Watsonville
Salinas
Monterey
Carmel
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Boulder Creek
Felton
Capitola
Aptos
Soquel
Gonzales
Greenfield
Bitterwater
Tres Pinos
Paicines
Chualar
Carmel Valley
Del Rey Oaks
Sand City
Freedom
Aromas
Hollister
San Juan Bautista
Los Banos
Los Padres
Big Sur
Pfeiffer
Point Reyes
Inverness
Bodega Bay
Fort Ross
Guerneville
Jenner
Ocean View
Dillon Beach
Tomales
Petaluma
Marshall
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Point Reyes
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Belvedere
Angel Island
Alcatraz
Yerba Buena
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Oakland Bay Bridge
San Francisco Bay
Richmond
Crockett
Martinez
Benicia
Port Chicago
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Travis AFB
Clayton
Mt. Diablo
Diablo
Danville
San Ramon
Castro Valley
Brentwood
Byron
Bethany
Tracy
Altamont
Mission San Jose
Niles
Sunol
Calaveras Reservoir
Alum Rock
Evergreen
Mt. Hamilton
Mt. Boardman
Mt. Stevens
Loma Prieta
Madrone
Coyote
Almaden
Holy City
Laurel
New Almaden
Lexington Reservoir
Los Gatos Creek
Guadalupe River
Anderson Reservoir
Coyote Reservoir
Pacheco Pass
Bell Station
San Felipe Lake
Hollister
Santa Rita
Fremont
Pinnacles Nat'l Mon.
Soledad
Paraiso Springs
Tassajara Hot Springs
Jamesburg
Arroyo Seco
Lucia
Pacific Valley
Big Sur
Point Sur
Julia Pfeiffer Burns State Park
Point Lobos State Reserve
Carmel Mission
Monterey State Historic Park
Custom House State Hist. Mon.
Larkin House State Hist. Mon.
Colton Hall State Hist. Mon.
Robert Louis Stevenson House State Hist. Mon.
Casa del Oro State Hist. Mon.
Presidio of Monterey
Pacific Bldg.
Monterey Bay Aquarium
Cannery Row
Fisherman's Wharf
Old Monterey
Monterey Peninsula
Del Monte Beach
Asilomar Beach
Pebble Beach
Carmel Beach
Carmel River
Point Lobos
Carmel Mission
Carmel Valley
Santa Lucia Mts.
Los Padres National Forest
Ventana Wilderness
Pinnacles National Monument
Salinas River
Salinas River State Park
Moss Landing
Elkhorn Slough
Elkhorn Slough Reserve
Watsonville Slough
Pajaro River
Pajaro
Aromas
Prunedale
Castroville
Marina
Seaside
Del Rey Oaks
Sand City
Monterey
Pacific Grove
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San Juan Bautista
Los Banos
Gilroy
Hot Springs
Morgan Hill
Sao Martin
Santa Cruz
Soquel
Aptos
Capitola
Monterey Bay
Felton
Boulder Creek
Swanton
Davenport
Bonny Doon
Big Basin
Santa Cruz Mountains
Los Gatos
Campbell
Saratoga
Santa Clara
Milpitas
Sunnyvale
Los Altos
Mountain View
Palo Alto
Menlo Park
Woodside
San Gregorio
Pescadero
Half Moon Bay
Belmont
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Angel Island
Alcatraz
Yerba Buena
Treasure Island
Oakland Bay Bridge
San Francisco Bay
Golden Gate
Golden Gate Bridge
Golden Gate Park
Golden Gate National Recreation Area
Presidio
Fort Point
Lincoln Park
Sutro Forest
Mount Sutro
Twin Peaks
Mount Davidson
Glen Canyon Park
Diamond Heights
Bernal Heights
Potrero Hill
Hunters Point
Candlestick Park
Islais Creek
Mission Bay
China Basin
Pier 39
Fisherman's Wharf
Ghirardelli Square
Aquatic Park
Marina District
Cow Hollow
Pacific Heights
Russian Hill
Nob Hill
Telegraph Hill
North Beach
Chinatown
Financial District
Civic Center
Mission District
Haight-Ashbury
Castro District
Noe Valley
Glen Park
Bernal Heights
Potrero Hill
Dogpatch
Hunters Point
Bayview
Visitacion Valley
Excelsior
Crocker-Amazon
Ingleside
Merced Heights
Stonestown
Parkmerced
Lake Merced
Sloat Boulevard
Great Highway
Ocean Beach
Fort Funston
Lake Merced
Daly City
Colma
South San Francisco
San Bruno

TOM MYERS

Above: One of San Francisco's seven hills, with Coit Tower on the right, Bay Bridge, Yerba Buena Island, and East Bay cities in distance.

Sitting proudly, like a queen amid her outlying areas, is shining San Francisco—to old Californians—"The City." Linked to the north by the Golden Gate Bridge, one of the wonders of the world, and to the communities of the East Bay by the seven-mile-long Bay Bridge, it is the traditional·cultural and financial capital of the West, as well as the gateway to the exotic lands of the Orient.

The San Francisco Bay area's equable climate and many natural and manmade wonders make it a mecca for tourists at any time of the year.

The lake-dotted rectangle of Golden Gate Park, a thousand-acre oasis of greenery, bisects the western half of the city. Flower lovers may wander through the 15,000-square-foot glass castle modeled after the main conservatory at Kew Gardens in London. Not far away is the Japanese Tea Garden, the Aquarium, and several museums.

The Fleischhacker Playground, Zoo, and Storyland occupies more than 30-acres just north of the sailboat-dotted waters of Lake Merced. Accessible from the south via Route

TOM MYERS

Above: Dragon paraded through Chinatown in Chinese New Year's celebration requires more than a hundred men and boys to handle it. Right: Sather Gate entrance to University of California at Berkeley.

ROBERT ROSE

"The moaning cypress trees lift somber arms up to skies of cloudless blue."

from *Wild Roses in California* by Grace Hibbard

Four thousand acres of this coast just south of Morro Bay are now Montana de Oro State Park.

35 (Skyline Boulevard) and the east (Sloat Boulevard), the zoo complex contains exotic animals from all over the world.

San Francisco is known as the home of good food. Almost anything edible is available in fine restaurants throughout the city. Seafood abounds in great quantity and quality at Fisherman's Wharf. The Cliff House offers good food and a magnificent view of the seals and sea lions disporting on Seal Rocks. Ghirardelli Square, west of Fisherman's Wharf, offers the delights of dining, shopping, and strolling amid the last-century atmosphere of a remodeled chocolate factory.

San Francisco's fabled Chinatown, the largest Chinese community outside the Orient, offers delicious food at reasonable prices and fascinating shops with a wide variety of wares.

Across the bay the City of Berkeley is the home of the 600-acre campus of the University of California, attended by more than 27,000 students and staffed by a number of Nobel Prize winners among its distinguished faculty.

Among the most interesting features of the campus are the tall spire of the Campanile, visible from throughout the bay area; the Greek Theatre; Sather Gate; International

PETER ASANO

Below: Unorthodox view of Cannery Row, Monterey, at dawn. Next below: Monterey County coastline in Big Sur country.

TOM MYERS

Three photos below, left to right, are all of Point Lobos State Seenic Reserve. Far left is China Cove, left center is Cannery Point and native stand of Monterey Pines, below is seaward view of Cannery Point, Carmel coastline in distanee.

JOHN ROBINSON

TOM MYERS

House, which provides a home for several hundred foreign students; the Cyclotron (Lawrence Radiation Laboratory), one of the few atom smashers in this country; and the library, which contains nearly 3,000,000 volumes and is the sixth largest among American university libraries. On display here is Drake's Plate, left on the California coast in this area by Sir Francis Drake in 1579 as proof of England's claim.

Adjoining Berkeley to the south is the City of Oakland; bustling, lusty urban center of the East Bay. County seat of Alameda County, now the largest county in northern California, with over a million residents, Oakland's rebirth has been the result of foresight and energy.

One of the "must" places to visit is Jack London Square at the foot of Broadway, where the port of Oakland got its start. Dedicated to the memory of the West's most famous author, it provides a choice among many restaurants and shops for the visitor.

South from San Francisco on US 101, busy freeways carry traffic through the "peninsula" cities where live many of the San Francisco Bay area's wealthy. Beyond is San Jose, once a quiet prune and dried apricot center, but

TOM MYERS

This view of Fisherman's Wharf in Monterey is another California seene loved by photographers.

JOHN ROBINSON

Ancient pepper tree dominates the garden area of one of San Juan Bautista's old buildings. Right: Silver nameplate of Angelo Zanetta on Zanetta House, San Juan Bautista. Below: Kitchen of Stevenson House, Monterey State Historical Monument.

JOHN ROBINSON

TOM MYERS

now a booming industrial complex which is predicted may become northern California's largest city.

Below San Jose the country gradually changes from industrial to agricultural, and here is another of the state's major wine-growing regions.

A few miles off the modern highway, but recommended for the casual tourist who wants a quick briefing on California history, is the state historic park at San Juan Bautista, with authentic examples of architecture and furnishings from several of the state's periods. In the center is the old plaza just as it was when the town was the hub for dozens of great Spanish ranchos.

Back on US 101, here truly the route of the old El Camino Real, is the thriving city of Salinas, lettuce capital of the world, and scene of the state's largest rodeo each summer. From Salinas southward to San Luis Obispo, 101 travels up the Salinas River valley, locale for many John Steinbeck novels.

The view gradually changes from intensely cultivated agricultural to mountainous cattle country little different from the way it looked when Spanish longhorns roamed it. This gradual transition from the busy, metropolitan atmosphere of San Francisco to the California of 150 years ago makes this one of the state's most charming trips.

The tradirional vacation spot of many families in the bay area is the beach city of Santa Cruz. On the coast about 75 miles south of San Francisco, out of the fog belt but easily accessible by Routes 1, 9, and 17, the mile-long beach is a paradise for sun bathers and surfers. Santa Cruz offers a fascinating Sea-Trees Triangle Tour on which motorists can quickly view the area's highlights from their cars.

Southward from Santa Cruz and just off Srate Route 1, a string of state parks with fine beaches line the coast all the way to Monterey, made famous by Steinbeck's "Cannery Row" books. This was California's capital during the Spanish and Mexican regime. Here are preserved many beautiful adobe homes from an older and more gracious period in California's history.

Monterey is at the northern end of the 17-mile drive, a toll route leading ro Carmel through some of the world's finest coastal scenery, and past the famous Pebble Beach Golf Course. Carmel has long been an artists' colony, and also has one of the finest missions in Father Serra's chain, San Carlos de Borromeo de Carmelo, founded in 1770. This was the second mission in California, and was Father Junípero Serra's headquarters. He is buried at the foot of the church altar.

A few miles south of Carmel is the magnificent Poinr Lobos Scenic Reserve, called "the greatest meeting of land and water in the world." From here south, the traveler on Route 1 will be intoxicated with beauty. For a hundred miles he travels along the hulking

Right and below right: Second one built in the chain, Carmel Mission is one of the most picturesque, and is situated in a beautiful setting.

PETER ASANO

THE MANILA GALLEON PASSED HERE

TOM MYERS

San Francisco Bay area people love the outdoors. This scene is on San Mateo County coast.

shoulders of the precipitous Santa Lucia Range, the road often suspended between sea and sky, with a constantly changing series of incredibly beautiful views. It was no idle chance this section was the first unit designated in the state's scenic highway system.

Near the south end of the stretch is Hearst Castle, baronial home of Willam Randolph Hearst, given the state as a museum and historic monument. It is popular and reservations are desirable.

Beyond Hearst Castle the road continues to Morro Bay with more fine coastal scenery, then swings inland to join US 101 at San Luis Obispo, home of California State Polytechnic College. Both Morro Bay and San Luis Obispo have good accommodations and restaurants, but there are several other sizable towns on US 101 between San Luis and Santa Barbara.

In this section of the state are some of California's greatest contrasts—booming metropolis and sleepy historical village, rich cultivated land and wild coastline—all tied together by two highways—US 101, El Camino Real, and State Route 1, the Cabrillo Highway.

TOM MYERS

PETER ASANO

Right: Sunset at Morro Bay. Great Morro Rock monolith in distance.

TOM MYERS

The Mother Lode

JOHN ROBINSON

JOHN ROBINSON

Above: Celebrations are fun in the Mother Lode towns, and each has its special day. "Bunting" hanging across State Route 49 in Angels Camp advertises Jumping Frog contest. This celebration is an annual event memorializing famous Mark Twain story.

"The bones of the weaklings who started for El Dorado in 1849 lie on the plains or in the hill cemeteries of the mining camps."

Will Irwin in *The City That Was*

JOHN ROBINSON

Above: All the elements of a Mother Lode Fourth of July are present in this parade in Nevada City. National Hotel has names of presidents and potentates on its old ledgers.

One hundred and eight years ago when James Marshall discovered gold at Coloma, thousands of people stampeded into the area stopping only to ask, "Which way do we go for the gold?"

Today Marshall is dead, the goldpans are at rest, and the hundreds who now travel the area more casually still stop—but only to ask: "Which way did the gold diggers go?"

The way is not hard to find.

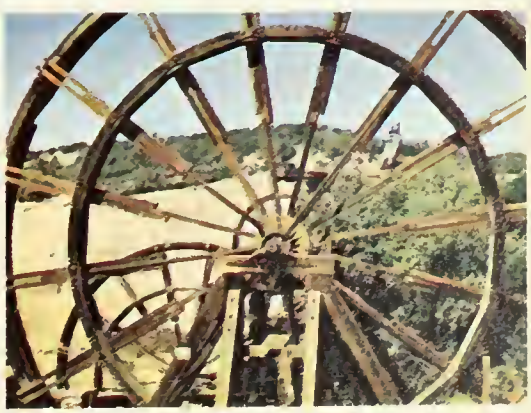
Old mines, a few still active, historical buildings and ancient sites of camps can be seen almost anywhere along the 289-mile length of State Highway 49, symbolically numbered for the "49'ers." The route sign is fashioned like a miner's shovel—the same shield that is used to designate all state highways in California.

The Gold Rush highway hugs the foothills at about the 2,000-foot elevation on the western slope of the Sierra Nevada, often following paths and trails cut by the early miners and their pack trains.

Aptly called "Highway Through History," Highway 49 is unsurpassed in the variety it offers the traveler. Anglers will find delight in the streams tumbling down the deep canyons through which the roadway dips and loops. Naturalists will find the concentration of native shrubs and wild flowers abundant and interesting.

JOHN MEYERPETER

Church and cemetery are in Mokelumne Hill.



Big wheels of Kennedy Mine in Jackson date only from early 1900's, but are beloved by photographers.

"SANDWICH ISLAND BEAUTY LIVES AGAIN"

PHOTOGRAPHS BY JOHN ROBINSON

The tiny man-powered fire engine pictured on these pages was ordered from its Boston manufacturers by the King of the Sandwich Islands in the early 1850's. Due to delays and shipping problems, it only got as far as the San Francisco wharves, from which a Columbia delegation rescued it. In the custom of its day, it already had been named "Papeete," and this name it still bears.

The red gravel hills, typical of the gold country, and a product of millions of years of layering, abound in geological mysteries, for those who take the time to look. These are the ancient riverbeds in which the nuggets were secreted.

There are several campgrounds and picnic areas, some on mountain streams, scattered along the Mother Lode Highway—and two state parks.

One of these is "Marshall Gold Discovery Park" at Coloma (Americanized from *Cul-lu-mah*, an Indian word meaning "beautiful vale"). Here at this quiet town just north of Placerville the world-shaking find is permanently memorialized.

In January 1848, Marshall, a millwright, was finishing a mill he had contracted for John Sutter, Swiss immigrant and founder of Sutter's Fort in Sacramento. Marshall chose a site on the inside bend of the river so that mountain water could be diverted to turn the water wheel.

With 20 men on the handles (center photo) Papeete's outlet hose is filled hard as a rock, and stream from her nozzle outcarries that of a modern commercial pumper despite its dials and big engine.

On the afternoon of January 24, 1848, he was inspecting a ditch below the mill and was attracted by some bright, yellow particles. By next morning the secret was out, the stampede was on—and the rest is history.

Six months later the little town of Coloma, until then host to only a handful of lumbermill workers, had about 300 frame buildings up or under construction and a population of 2,000, which skyrocketed to 10,000 before the restless miners left it for other more golden fields.

Shovels were soon scraping in river gravels from Mariposa all the way to the Sierra Buttes, with miners in good diggings getting an average of eight ounces, or $128 worth, of gold a day. Some found single nuggets worth $5,000 and more (California's record was a nugget worth $73,710).

The South Fork of the American River flows through Coloma today much as it did in Marshall's time, but the population has dwindled to a few hundred. In the quiet historical

Superbly reconditioned in recent years by the local volunteer company with the help of artist Charles Surendorf, Papeete is a star in the annual Firemen's Muster Day sponsored by the Mother Lode firemen, and held at Columbia State Historic Park each spring.

JOHN ROBINSON

These reminders of another day are in the peaceful little town of Dutch Flat, only a few miles off the busy modern Interstate 80 transcontinental highway. The town once boasted a population of many thousands as a hydraulic mining center.

JOHN ROBINSON

park the state provides picnic tables and barbecue grills, set serenely in a shaded grassy area protected by a rustic wooden fence. A huge statue of Marshall stands on the hill overlooking the town which he made famous.

About a hundred miles south of Coloma, and near Sonora where Highway 49 and Route 108 intersect, is the little town of Columbia, which is being restored in an ambitious undertaking by the State Division of Beaches and Parks. It, too, is a state historical park, so designated in 1945.

Columbia is an architectural showplace and attracts visitors the year round. Its attractive brick buildings are the original existing structures from the boisterous era of a century ago. Because the town was burned several times most of the buildings were finally reconstructed of brick and iron, and have stood the passage of the years better than those in most ghost towns. The Wells Fargo Express Office, Gold Nugget Saloon, St. Anne's Church and the Masonic Hall, all built between 1854 and 1858, are still intact and furnished in much the same manner as they were then. Columbia was one of the largest towns in the Mother Lode country with a population of 15,000 and its mines yielded over $87 million in gold. At that time it had 30 saloons, 143 faro games, hotels, 3 theaters, 4 churches, and a Chinese playhouse.

A few ghost towns are located just off Highway 49, and one of the best is Volcano in Amador County south of Placerville, about 12 miles east of Sutter Creek. It was a reckless, rowdy, typical gold boomtown living up in every way to its contrary name—but except for the 49'er uproar there has never been a volcano in Volcano.

Similarly, Fiddletown, located six miles off Route 49 north of Plymouth in Amador County, was reported not to have had a single fiddle in it; and Dry Town had, at the peak of its prosperity, 26 saloons. On the basis of the foregoing, no inquiry was made about Angels Camp. Helltown, Loafer Flat and Bedbug, however, are all believed to have honestly lived up to their names.

Nevada City and Grass Valley, on Highways 49 and 20 north of Auburn in the area of the northern gold mines, not only rate high in local color and centenary history, but have made a graceful transition from the stage age to the space age.

Miners around Nevada City found their rewards not in placer mining (in which gold is obtained by washing) but in deposits deep in the river bed. These were mined with small shafts known as "coyote holes" which became so famous that a main thoroughfare in Nevada City is still called Coyote Street. Later a number of deep "hard rock" mines were developed, and the extensive Malakoff hydraulic diggings several miles west were also operated several years. Today these diggings also are being put aside as a historical park.

North San Juan, which has an original Wells Fargo Building, was once the center for big hydraulic operations. At nearby Camptonville is a modest memorial to the inventor of the Pelton water wheel.

Further north, traveling toward Downieville and Sierra City, Highway 49 terrain becomes increasingly more rugged and typical of the Sierra high country. Of interest in Downieville is the Pioneer Museum and a grocery, still in use, dating back to 1852.

Highway 49 from one end to the other is full of interest to the curious traveler and open to auto exploration without limit. Perhaps its greatest lure, however, is not found in the abandoned gold mines, interesting though they are, nor the buildings of another era, but in the aura of the unexpected, the sudden discovery, the memories of a people not far removed from our time who, for a few brief, tumultuous years lived the great adventure as we all secretly wish we could.

JOHN ROBINSON

In contrast to the drowsy quiet of the deserted Mother Lode towns, Saeramento and Stockton, which were once Mother Lode freight centers where hundreds of paek trains fanned out each day, are now modern eities. New eight-lane Interstate 80 Pioneer Memorial Bridge is under construction in Sacramento.

For the visitor to the old mining towns there is infinite reward in the architectural reminders of another era. The crumbling structures which once echoed the sound of clumping boots and vigorous, youthful voices today offer a silent, nostalgic charm.

JOHN MEYERPETER

JOHN MEYERPETER

"New towns were laid out in the valleys to supply the camps, and those already established grew with astonishing rapidity."

from *Mining Camps* by Charles Howard Shinn

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TOM MYERS

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Next Issue

One of the features of the next issue will be a study of urban transportation problems and growth in the City of Long Beach. It is hoped to make this a continuing series of articles which will appear from time to time in these pages.

Today California has 13 designated urban areas, and, although Long Beach is a part of the greater Los Angeles complex, because of its size and distinct character it is here treated separately.

CALIFORNIA
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VOLUME 45 JULY–AUGUST 1966 NOS. 7–8

AUTOMATIC LANE CONTROL 2
By V. H. Waight

SAFETY MOVIE 8

WALKER CANYON 10
By Earl Rogers

CHULA VISTA WHALE 12

A PLEA FOR FOSSIL VERTEBRATES 13

NATIONAL HIGHWAY WEEK 16

FREEWAYS ON CANVAS 17
By Eleanor N. Wood

CRESTLINE INTERCHANGE 18
By Tek Tanaka

LOOK, MA, NO TRAFFIC LIGHTS! 22
By Charles F. Gustafson

UKIAH TO BOONVILLE 26
By Brian T. Colwell

MAD RIVER-BLUE LAKE FREEWAY 28
By Ernest J. Reed, Jr.

GRAND OAKS STUDY 30
By Stuart L. Hill and Christos Brianas

SEARCH FOR A FLAGPOLE 33

OASIS TO STATE LINE 34

B.A.R.T. 36

EMBALMER BUILT BRIDGE 38
By Donald D. Chamberlin

ORIGIN AND DESTINATION STUDIES 40

MERCED CITY-COUNTY JOB 44
By Verne L. Davis and Howard Carter

STEVENS CREEK FREEWAY 45
By Robert N. Keller

THE NOISE LISTENERS 46
By Charles F. Gustafson

NEWTON H. TEMPLIN, 47
1904 TO 1966

BYLINES 48

"An outstanding network of state highways is essential to the future growth of California's economy"
—*Governor Edmund G. Brown*

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Editors are invited to use information contained herein and to request prints of any black and white photographs.

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FRONT COVER: Scene on location of crew working on new movie for training Division of Highways maintenance men in correct safety procedure for protecting themselves from traffic. In foreground are Gerhard Busing, left, and H. C. Hall, from Burlingame Maintenance Station. Standing behind Hall is Frank Bunyard, Assistant Safety Engineer. Cameraman is Peter Asano, and rear left is Richard Jones, director. Remote control photo by Peter Asano.

BACK COVER: Photo shows a section of Route 58 looking east about 12 miles from Bakersfield, where road begins climb toward Tehachapi Pass. This is an important entry route into California from the east and, although not in the interstate system, is being progressively converted to full freeway along its entire length. Photo by Robert Mulno.

automatic lane control

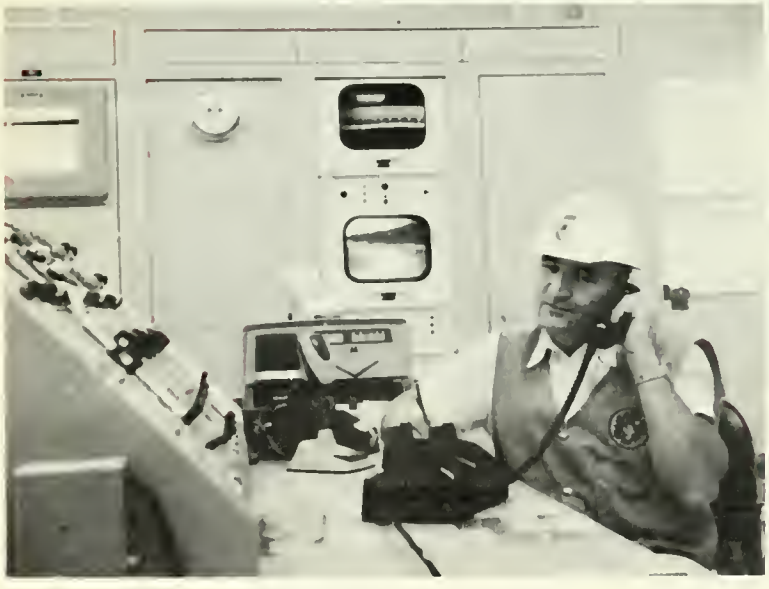


PHOTO ABOVE—The freeway approach lanes and the east portal of the Caldecott Tunnel are visible in the foreground of this aerial photo. Beyond the Berkeley Hills is the City of Oakland.

PHOTO LEFT—The tunnel control room with television monitor in the background.

BY V. H. WAIGHT

Most people accept the fact that something flowing through a tunnel in one direction can be made to flow in the opposite direction, and let it go at that.

However, when the something happens to be a stream of cars, there's a trick to reversing the flow without confusion or accidents.

At Oakland's Caldecott Tunnel, where the direction of traffic through the central bore must be reversed twice daily, the problem has been solved by an automatic lane-control system of changeable message signs and markers and barriers that can pop up and down out of the pavement at the touch of a button. Further checks and aids are furnished by closed-circuit television and an antenna system that allows motorists to receive radio broadcasts inside the tunnel.

The Caldecott Tunnel on Route 24 is the main traffic artery between San Francisco and Oakland and the fast-growing cities and communities east of the Berkeley Hills in Contra Costa County. More than 54,000 vehicles use the route daily.

The original tunnel was built by Joint Highway District No. 13 in 1937. Known as the Broadway Low-

INSTANT MESSAGE CHANGES. Highways employee stands under one of the changeable message signs on approach to tunnel (photo right). At his signal a second employee at the control box activates prisms which flip (middle photo) to new message telling motorists that both tunnels are open (bottom photo).

Level Tunnel, it had two parallel two-lane bores, each 3,400 feet long, and was considered an engineering wonder of its time.

It was taken into the state highway system in 1948.

As traffic increased and the original tunnel became inadequate, construction of a new four lanes of tunnel seemed to be the answer. However, further consideration offered a less expensive solution.

The traffic was strongly directional —heavy westbound in the morning (people going from their homes east of the hills to jobs in Oakland and San Francisco), heavy eastbound in the evening (the same people returning home).

Why, the engineers reasoned, could not the problem be solved at half the cost by building another two-lane tunnel and making it reversible in favor of the heavier traffic direction?

Investigation proved that the plan was sound. Construction of the new tunnel and approaches and the automatic lane control system was completed last year.

How Lane Control Works

What is the new lane-control system and how does it work?

A motorist approaching the tunnel encounters three different kinds of things that warn or guide him: First, changeable message signs; then a series of flexible barriers or popups; finally, a rigid positive barrier to make sure that he does not cross over into opposing traffic.

There are four changeable message signs at each end of the Caldecott Tunnel. The signs have two or three message lines. Each line is a horizontally mounted prism which can be rotated by an electric motor, using a control circuit similar to that used for a home television antenna rotor, and expose the desired message or warning.

The flexible barriers are a series of posts at each end of the tunnel in front of the positive barriers. These posts are hollow cylinders or tubes which rise out of the pavement; thus the name popups. Raised, they are about 28 inches above the pavement; lowered, the top of the tube is flush with the pavement surface.

The tube is made of flexible yellow plastic with a band of reflective material at the top so that it can be seen day or night. Its rigidity depends upon its cylindrical shape alone. Thus it can be hit by an auto with no damage to the vehicle and little or no damage to itself.

Each popup is operated by a double-acting air cylinder which raises and lowers it. Lowering by air is an added insurance because the force of gravity is sometimes not enough to lower the popup into its socket if it becomes sticky with dirt or mud. A sump under the line of popups serves to collect dirt and can be flushed out.

The positive barriers, in contrast to the flexible barriers or popups, are designed to stop and prevent vehicles from crossing over into opposing traffic. Each is a cable barrier 120 feet long that rises out of the pavement. To provide enough strength to stop heavy vehicles each barrier has two anchor posts and 14 heavy steel uprights. Strips of fluorescent red plastic cloth

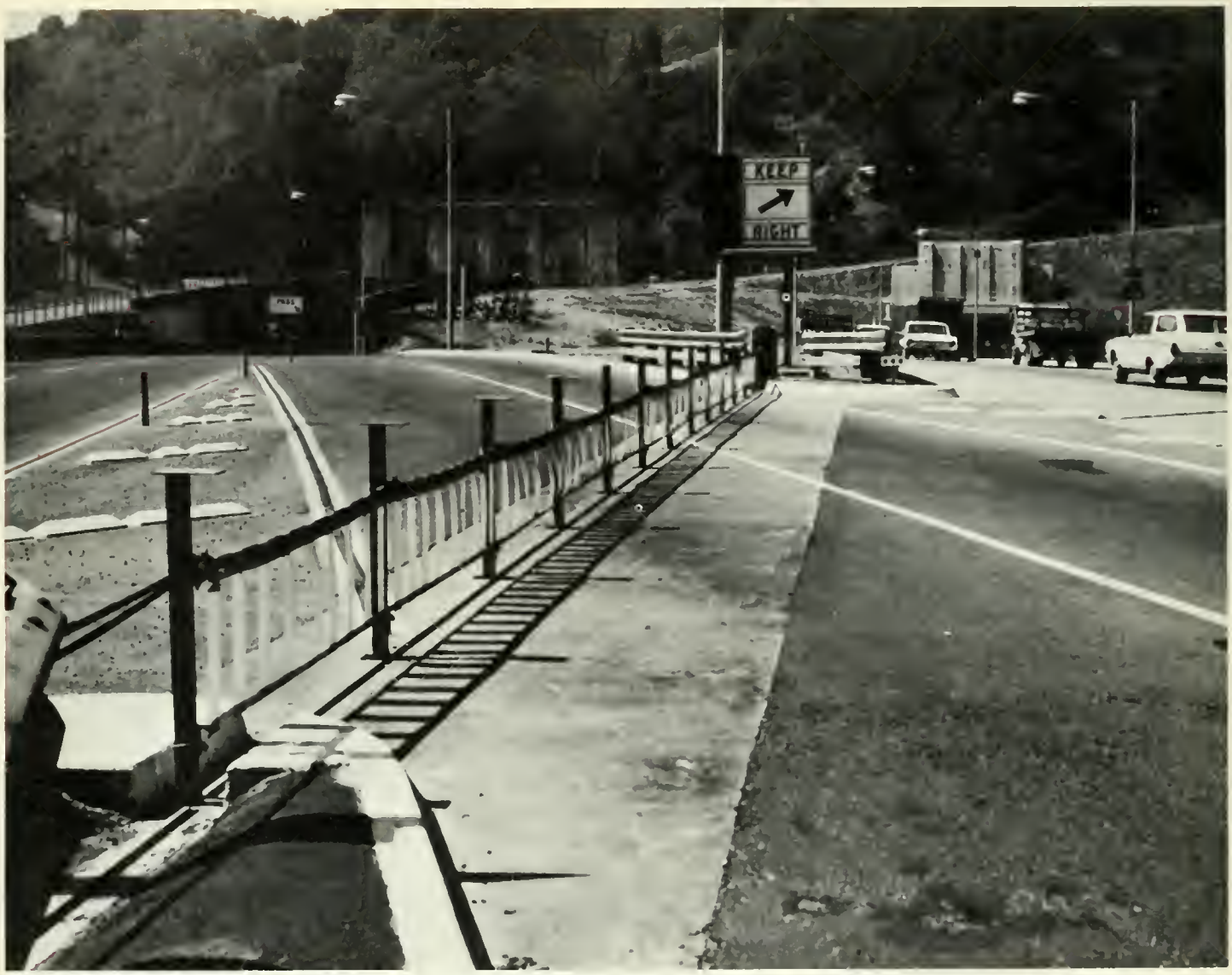


PHOTO ABOVE—A positive barrier, shown here in raised position, is designed to stop vehicles from crossing over into opposing traffic lanes. PHOTO RIGHT—Positive barrier in lowered position.

A popup in raised position. Made of flexible plastic, it can be hit by an auto with no damage to the vehicle and little or no damage to itself.

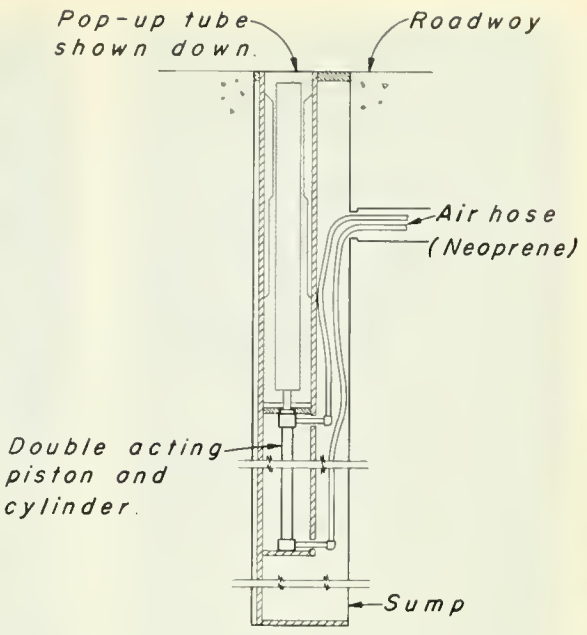


Diagram of popup in lowered position. The popup is operated by double-acting air cylinder. Lowering by air is an added insurance because gravity is sometimes not enough to lower popup if it becomes sticky with dirt or mud.

fastened on the barrier increase visibility.

At present a section-by-section changeover performed by two employees is used in making any reversal of traffic flow.

This procedure, though somewhat unsophisticated in this age of automatic switches and controls, is still considered necessary to make sure that the roadway is clear before the popups are raised (imagine a motorist's reaction if a series of posts suddenly rose out of the road ahead of him!), and that the center tunnel is clear of traffic in one direction before vehicles headed in the opposite direction are allowed in.

Step-by-Step Example

As an example, let's assume that westbound traffic is now using the tunnel and we want to change the traffic flow to eastbound.

The two-man crew moving with traffic drives down the center lane and stops beside the first control box located in the median about one-half mile east of the tunnel entrance.

Here one man observes traffic until a suitable break or interval occurs. For example, experience has taught him to be on the lookout for groups of vehicles held up by a slow truck in the lane next to the one in which the popups are to be raised. This is a time when it is unwise to raise the popups because an auto is likely to suddenly decide to pass the truck and pull out into the string of popups.

At the first man's signal that the traffic pattern is O.K. the second man pushes buttons which change messages on the first three signs to direct traffic out of the left traffic lane. When indicator lamps flash that the message changes have taken place, he pushes the button to raise the first 12 popups.

Now they proceed to the next control point and raise the next 12 popups. At the third control point they change the message on the fourth sign from two arrows pointing to both tunnels to one arrow pointing to the right. After raising the popups on the back side of the positive barrier, they push the button to raise the positive barrier itself, closing the middle tunnel to all westbound traffic.

The crew now drives west through the middle bore to make sure that it is clear of all westbound vehicles. Emerging from the tunnel, they stop at the control box nearest the tunnel and lower the positive barrier and the popups behind it. At the next control box they change the directional arrow sign to show that both tunnels are open. Continuing west, they stop at the three remaining control boxes, lower all of the popups and change the messages on the three approach signs to read BOTH TUNNELS OPEN. Eastbound traffic can then use the middle tunnel.

Fast change by remote control is essence of the new system

MESSAGE CHANGE. In the photo sequence above a press of a button flips message prisms in a sign changing double arrows to single arrow and "keep right."

Any Bugs in New System?

How is the new lane-control system working? Pretty well, so far. Some bugs did occur in the beginning, however, that had to be corrected.

For example, although the popups worked well, rising and falling quickly when they should, there were times under certain lighting conditions when their bright yellow seemed to blend with the color of the pavement and they were not easy to see. Adding fluorescent red bands on the popups solved the problem.

Also, although collision tests between vehicles and the popups were made before they were installed, in day-in and day-out operation some of them were torn off when struck by a car. This was solved by strengthening the connection between the tube and the raising piston.

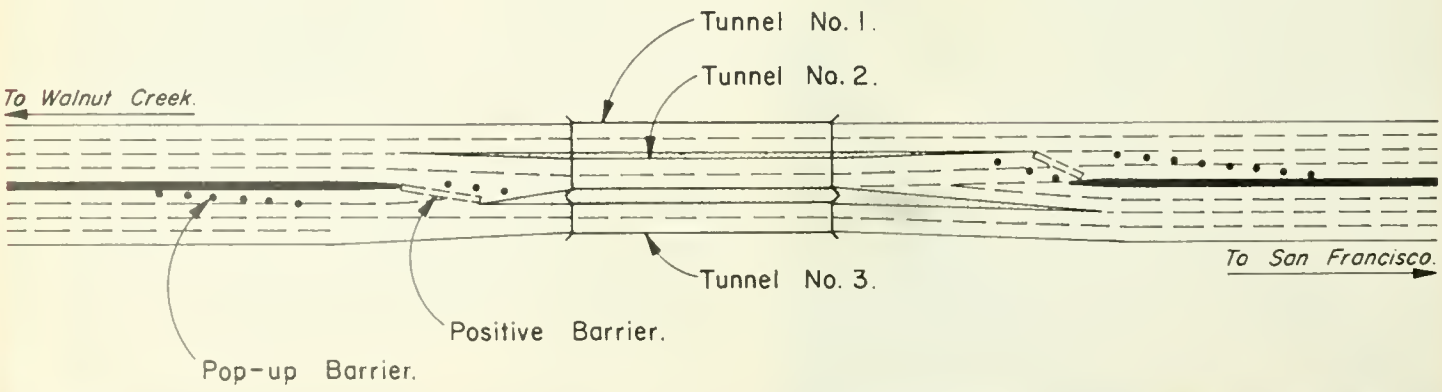
Change of the reflective material on the popups from a material that proved to be somewhat brittle to a softer material has also reduced wear and tear.

The positive barriers have also functioned well. To date collisions against them have been few and none serious. In all cases the cable has deflected the vehicles and kept them from swerving over into opposing traffic and almost certain injury or death.

Radio Progroms Inform Motorists

As in many other metropolitan areas, several radio stations in the San Francisco Bay area broadcast information to automobile drivers during morning and evening commute hours.

Along with popular music, news, and chatter, announcers and disk jockeys give reports on road conditions covering accidents, flooded areas, fog, debris on pavement, and fires which they get from the State Division of Highways, California Highway Patrol, local police and sheriff's departments. Some of the most pertinent and up-to-date information comes from



A simplified diagram of the Caldecott Tunnel lane control system showing the location of the popups and positive barriers at each end.

motorists considerate enough to stop and telephone in to report on something they have just encountered on the road.

More recently, radio stations have begun using reports from airplanes and helicopters whose pilots can observe traffic conditions on a broad scope not possible on the ground.

Foreknowledge of trouble allows a motorist to choose another route and bypass the congested or blocked area, benefiting not only himself but also local law enforcement personnel who have less congestion to deal with.

Some mornings disk jockey Don Sherwood even suggests to any of his listeners whose way to work lies through some area of massive traffic tie-up that they wait at home for a while and have an extra cup of coffee rather than getting caught in the backup and spending an hour or two in their cars.

Thus far no evening disk jockey has jeopardized his popularity by suggesting that his listeners remain longer at work rather than getting involved in a traffic jam on their way home.

Closed-circuit TV Surveys Traffic

A closed-circuit television system at each entrance of the tunnel makes it possible to keep the approach roadways under surveillance from the control room at any time.

Operated by remote control, the cameras can be made to pan, tilt, or zoom in on any special portion of the traffic scene below to get a closer look.

The cameras can also be focused and the light exposure changed from the control room.

Each camera is connected with the control room by two cables, one for electronic circuitry, the other for pan and tilt control.

The scene picked up by the cameras is picked up on black-and-white screens in the control room.

The west approach camera assembly is located on top of the control building. The east approach camera was first installed on the roof of the east portal building. However, in spite of its relatively inaccessible location, someone managed to get up on top of the building and steal the entire camera assembly in December 1965. The replacement camera is located inside the portal building and looks out on to the approach roadways through an opening in the concrete face of the building.

Radio Reception Problem Solved

As early as 1947 the Department of Public Works was instructed by the State Legislature to install wires or other devices to improve reception of broadcasts by radios in cars passing through tunnels or underpasses.

Such installations, usually wires strung on insulators, proved of some use through shorter tunnels such as the Waldo Tunnel in Marin County or the Park-Presidio Tunnel in San Francisco. But in longer tunnels such as Caldecott, reception from most stations dropped off to nothing a short distance inside.

At first the problem seemed insurmountable and "beyond the state of the art." However, like many other "impossible" problems, it was solved.

A manufacturer was found whose radio experts came up with a system that involved amplifying the radio signal in the tunnel so that it could be picked up by car radios. The broadcast boosting system had three components: a receiving antenna; an amplifier; and a pair of transmission lines running the length of the tunnel.

The antenna is an upright whip of stainless steel standing nine feet high. It is placed outside the tunnel at a spot where it can pick up local AM stations and still be far enough away so that it will not pick up feedback from the transmission lines inside the tunnel.

The antenna is connected with a coaxial cable which is connected to the amplifier that boosts radio signals on the AM broadcast band. The amplifier in turn is connected to the transmission lines.

The radio-frequency energy from the amplifier creates a large enough cylindrical field to surround each transmission wire that the whip antennas of cars passing through the tunnel can pick it up, so that the motorist gets good reception on his radio along the entire length of the tunnel.

One distant radio station reports that its listeners receive it better inside the tunnel than outside.

To insure a constant field of strength along the entire length of the wire, a resistor is installed at the far end of the tunnel (from the amplifier), connecting the wire to the ground and completing the circuit system.

PHOTO TOP—Television camera set into the east portal face of the tunnel. Camera can be made to pan, tilt or zoom in on special area for closer look, all by remote control. LOWER PHOTO—A typical view of traffic as seen on one of the television monitors in the control room.

Crew working in field, left to right, includes Peter Asano, cameraman, Richard Jones, director, and Frank Bunyard, Assistant Safety Engineer. Maintenance men are from San Mateo station.

safety movie

Approximately 2,000 maintenance men assigned to the California Division of Highways are going to see a very special movie—a movie that quite possibly will save several of them from being killed.

The film is the result of the safety section's long-time study of methods for controlling traffic around maintenance work being done on highways. Produced by the audio-visual section, it illustrates the newly adopted lane closing techniques and flagging procedures employed by our maintenance forces.

Although the same basic patterns are now employed throughout the state, variations have existed, and the procedure outlined in the movie is designed to help standardize statewide practices wherever physical conditions will permit.

An extra bonus in safety for motorists may accrue. Once the procedure is in effect, drivers who come upon a lane closed by a Division of Highways maintenance crew will be confronted generally with a predetermined set of physical factors and driving conditions. After having driven by two or three of them, drivers should begin to know exactly what to expect and how to react to the situation.

It is envisioned that similar methods of controlling traffic around contract construction work can be effected when the type of work dictates such treatment.

Basically, the new procedure will depend not only on a standard format, but upon brilliantly colored warning devices to attract the attention of drivers and upon the use of trucks to protect workmen from passing traffic.

When approaching a repair area, the first thing a driver will see will be three red flags flying at least six feet above the ground. Mounted on the same flagpole will be a large, yellow diamond-shaped sign. In the case of a multilane thoroughfare the sign will read LANE CLOSED AHEAD. When a two-lane highway is involved, the sign will read FLAGMAN AHEAD.

In locations where traffic is heavy, a series of these flag-and-sign combinations will be placed along the approach to the work area. This transitional area will vary from 600 to 3,000 feet. On a job where only a few vehicles will pass, a single set of flags and its accompanying sign will be located from 600 to 1,000 feet in the foreground.

Once past the flags, drivers will be guided into the proper lane by a series of cones. The cones are painted bright orange or yellow and will form an eye-catching, symmetrical pattern designed to channel traffic through the sensitive zone in the safest manner.

In all repair work where a lane closure is involved, the maintenance men will be protected from oncoming traffic by an orange-colored truck that screens them from other vehicles. Mounted high on the traffic side of such trucks are flashing amber lights and a sign that reads (in black letters on a white background) PASS. Arrows indicating the direction in which it is safe to pass are included on these signs.

A seeming paradox exists in the use of flagmen to control traffic. Where at first glance it might appear they are needed most on busy urban freeways, such is not the case. The fact that several lanes are available to traffic is an outstanding safety factor in itself. The need is imperative, however, when work is being done on a two-lane conventional highway where opposing traffic is to be forced into a single lane. In such situations, a flagman is stationed at least 100 feet in advance of either end of the job. It is the duty of these two men to work as a team in not only slowing down traffic, but also in directing it in orderly fashion past the work area.

The flagmen, like all members of the work crew, will wear vivid red safety vests and white hard-hats.

Frank Bunyard, center, explains mockup used for movie sequences to Ed Tinney, right, State Maintenanee Engineer, and Assistant Maintenance Engineer Harvey Towne, left.

WALKER CANYON

BY EARL ROGERS

About midway of job, wagon drills, lower center, are preparing powder holes for blasting to cut through rocks. San Diego and Arizona Eastern Railway crosses highway at top of photo.

Structural plate pipe, 144" diameter, used for culverts on job, is engineered to handle flash floods from summer thunderstorms.

Before de Anza led his soldiers across the lower Colorado; even before Coronado roamed the Southwest in his search for the Seven Cities of Cíbola, Indians lived in Walker Canyon or passed through it on their journey to the mountains and seacoast. They ate the agave cactus and piñon nuts. They drank from the seeps and springs.

Today you can pick up bits of their pottery. In secluded caverns you may discover their faded pictures painted on the rock walls.

We're building a freeway down Walker Canyon now. It's a strange, harsh, remote region where mountain and desert come together in a kind of mortal combat. A faulted, folded jumble of weathered rocks, of hardy oaks, of juniper, mesquite, and barrel cactus.

In this rocky domain, you now see rubber hose strewn about like spaghetti. Carbide bits of a dozen wagon drills clatter against the hard granite, and clouds of fine rock dust envelop the drillers. Laborers on ropes and extension ladders batter holes in the big boulders with hand-held jackhammers. Powder crews lower detonators into the holes on long thin wires. They pour in the explosive and gently tamp it with a long wooden pole. Tractors claw at the rocky ground with steel ripper teeth.

It's a world of action. It's a strident symphony of clanging metal, of diesel-driven compressors, and bellowing bulldozers.

In contrast, on nearby slopes, wildflowers bloom after spring rains, and the pale lavender manzanita blossoms are alive with wild honeybees. Boulders big as a house have been sculptured by the wind into grotesque shapes. If you're lucky you may see bighorn sheep, though they're timid creatures and don't often show themselves to humans.

The Walker Canyon project begins near Boulevard, in the southeast corner of San Diego County. It runs 10 miles to the Imperial county line, crossing the San Diego & Arizona Eastern Railroad at the upper end of Carrizo Gorge.

Low bidder on this $8 million proj-

ect was the Daly Corporation of San Diego. Their bid price for 2,780,000 cubic yards of roadway excavation was $1.40 per cubic yard. This, together with 49,500,000 station yards of overhaul, accounts for half the project cost.

Drainage

With the exception of a bridge crossing at Carrizo Creek, all drainage is handled by corrugated metal pipe culverts. There are 18 different culvert sizes ranging from 24-inch factory-riveted CMP to 144-inch structural plate pipe. The structural plate pipes alone weigh almost 400 tons and required three railroad cars for delivery from the manufacturer's plant in Ohio.

The largest culvert is 276 feet long, of 12-foot-diameter structural plate pipe. It is assembled in two days' time by bolting together about 280 corrugated metal plates weighing 350 pounds apiece. A four-man crew then clambers over the top and sides with air-driven wrenches tightening more than nine thousand ¾-inch bolts. In two more days they're all snugged up and the pipe is ready for backfilling.

This 12-foot-diameter pipe serves both as a drainage way and a vehicular access to a small portion of the Anza-Borrego Desert State Park, which is landlocked by the freeway.

Because park regulations call for preservation of all natural features, the contractor has erected signs on his haul road that read "Entering Park Area." The State Division of Beaches and Parks forbids disturbance of the natural ground outside slope lines; even tire tracks.

The largest drainage way is Carrizo Creek, which drains a 100-square-mile basin in Mexico. Since topographic maps of Mexico were not available, the runoff and peak flow estimates were based on historical records of the San Diego & Arizona Eastern Railroad. This railroad crosses Carrizo Creek on a trestle built in 1916 several hundred feet upstream from the present freeway right-of-way. It passed a record flood in December 1926 without washout.

In designing the Carrizo Creek bridge we used the criteria the waterway should pass a peak flood of 10,000 cubic feet per second, with the area of the opening not exceeding that of the railroad trestle.

Right-of-way

Walker Canyon and the region surrounding it seem isolated from the rest of the world. Families who have lived there for generations still raise cattle in spite of many years of drought.

"Some of those big oaks may be 400 years old," said Lloyd Lovell, whose father homesteaded here. "But they're dying for lack of water."

The Division of Highways has acquired land for a public stock trail so ranchers will have access to grazing lands and water in the canyon.

An undercrossing near the east end of the job will provide the Bureau of Land Management with access to its wildlife refuge area in the Jacumba Mountains.

Interchanges

A diamond interchange serves the resort town of Jacumba. In the 1920's and 30's, Jacumba was a vacation spot popular for its mineral waters and hot springs.

Truckers approaching the 10-mile, 6-percent downgrade to Imperial Valley will have an off- and on-ramp to a parking area for testing their brakes and equipment.

Survey Party Chief Walter Butcher, a District 11 employee, setting slope stakes in rock.

At the San Diego-Imperial county line, an interchange will give motorists the use of In-Ko-Pah Park. It's a quiet, peaceful little park owned by the County of San Diego. There are shade trees and benches under a grape stake pergola where you can sit and watch the mountain birds ride the wind currents. Far down in the desert the harsh glare of the sun reflects off the sand dunes in the Superstition Hills. On a clear day you may catch a gleam of blue off the southern end of the Salton Sea.

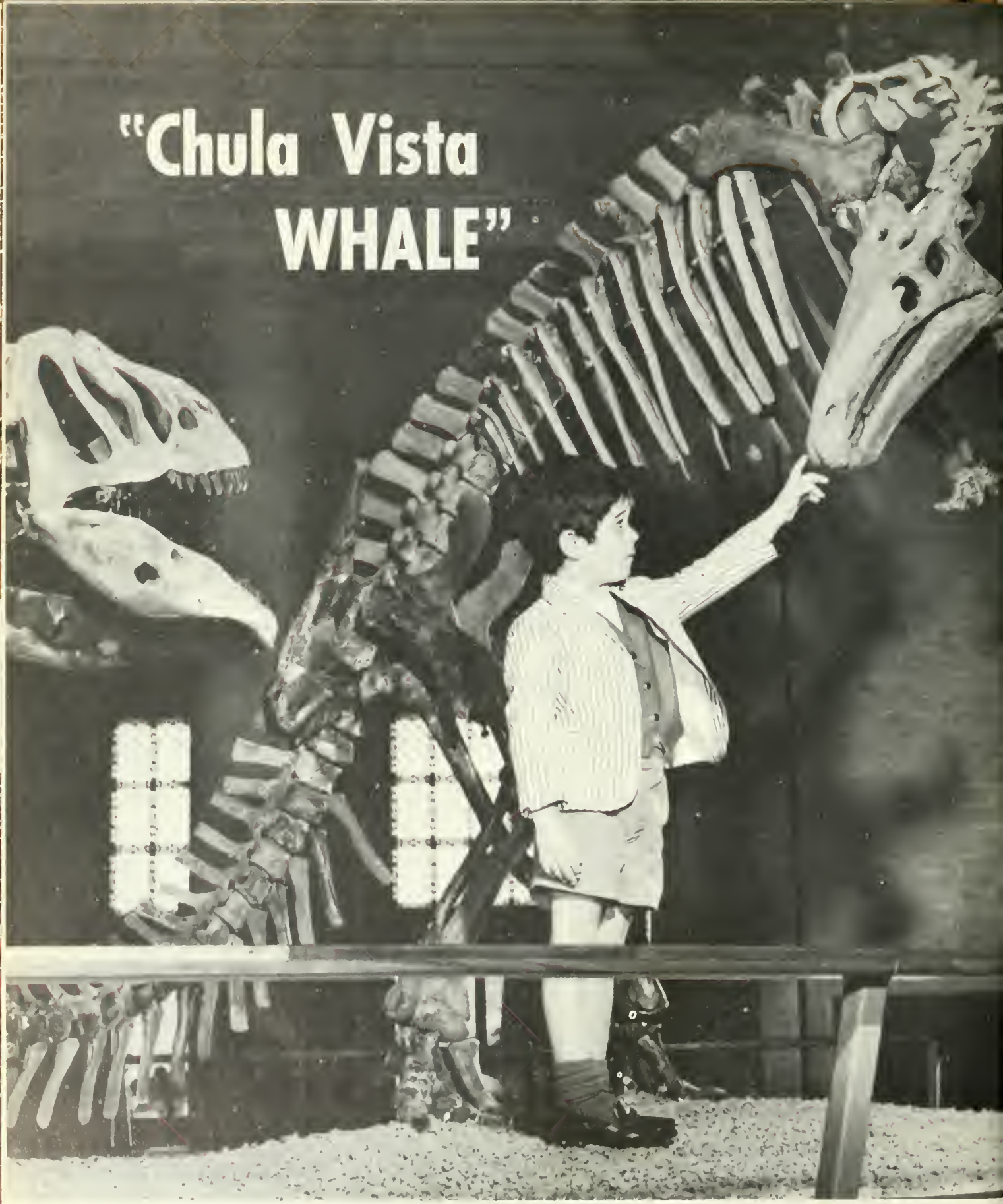
During the middle of the last century Walker Canyon, because of its remoteness, was an excellent hideout for fugitives from justice. There are people who suppose that it was named after William Walker, who organized an expedition to capture the Mexican State of Sonora. He surrendered to U.S. officials in 1853 to avoid capture by the Mexicans. Whether he ever used the canyon as a hideout is not known. He was executed by a firing squad while trying to establish a republic in Baja California.

In all likelihood Walker Canyon was named for George P. Walker, a more responsible if less colorful character who owned property there in 1869 and was trustee of Milquatay School District in 1871.

We hope that future travelers on Interstate 8 will treat Walker Canyon with the dignity it deserves. We hope that they may feel a hint of its wild, solitary beauty.

We ask you boys and girls of future generations to fight off this madness that compels you to immortalize yourselves in red paint on the side of a rock. And please don't throw papers in the park.

"Chula Vista WHALE"



To the eager and inquisitive young mind, a fossilized monster from past geologic ages is a fascinating object which brings to life the sometimes dry subjects taught in school.

Last spring, the children in Mrs. Leona Wulff's fourth grade class at Gregg Rodgers School, Chula Vista, were studying rocks. Tommy Holz and Kevin Bailey brought in some strange-looking samples they had broken off a larger piece found jutting out of the side of a cut slope where grading was being completed for construction of Interstate 805. Later, classmate Loren Larson helped get some more specimens of the strange rocks, and Cindy Weichert took some pieces home to show her dad, who is an amateur geologist.

He pronounced them fossils.

A scientist or two dropped by later, and identified the outcropping as the head of an extinct whale, dead perhaps 30 million years. About this time someone apparently took the ear bones, the most interesting single pieces in the skeleton.

By the time someone called Dr. Reid MacDonald, topnotch paleontologist from the Los Angeles County Museum, quite a few people had visited the find, and most had to have a sample.

Somewhat ruefully, Dr. MacDonald definitely identified the skeleton, but said it was already so battered its value was destroyed. He pointed out to the school children who had discovered the fossils in the first place, that scientists recovering the skeleton would have left several inches of earth all around, when readying the bones for removal and later cleaning and reconstruction.

Dr. MacDonald suggested the children make a class project of recovering as much of the skeleton as they could, but unfortunately, the local newspaper did a feature story on what it called a "prehistoric Moby Dick." Souvenir hunters descended on the battered old whale, and completed the destruction.

No one was at fault, of course—it was just a case of lack of knowledge. In later correspondence, Dr. MacDonald sent the article which follows. He said that although no highway people were in any way involved in the tragic series of events, he would appreciate it if we could use any part of it.

"It would be a great help to my profession if this type article were more widely read among highway and construction people," he said.

Not because Dr. and Mrs. MacDonald have been readers of *California Highways and Public Works* magazine for many years, but because it is a good and informative article, we are reprinting it herewith in toto.

A Plea for Fossil Vertebrates*

BY DR. REID MacDONALD

A few days ago I read an article which roused me to a mood of letter-to-the-editor writing. The September issue of *Mineral Information Service* contained a well-written and documented article entitled, "A Trip to a Vertebrate Fossil Locality." To a curator of vertebrate paleontology, this was comparable to a jeweler being told that the Mafia had been given the combinations to his safes.

Before you toss aside this issue in righteous indignation and write your letter to the editor canceling your subscription, let me explain why the vertebrate paleontologist is horrified at the thought of this kind of information being made public. A few examples from my own experience will illustrate the point.

Several years ago, I visited a very famous vertebrate fossil locality in Idaho with a prospective "angel." We were thinking of reopening this quarry to collect enough material for a museum exhibit and for our reference collection. At the quarry site we found the complete skeleton of a fossil horse about the size of a modern cow pony strewn around the dump. The bones had been hacked out in hunks not more than 8 to 10 inches long. The only parts of the skeleton missing were the teeth. The otherwise perfect and complete skull had been broken up to remove the teeth.

I suppose that the average reaction is "So what?" but to me this is the worst kind of vandalism. This skeleton, if properly and painstakingly collected, would have been a perfect piece for exhibition in a public museum or a prized study specimen to be used as a standard of comparison for material brought to our museum from local sources. To those of us who devote

* Reprinted from *Mineral Information Service.*

Below: Mrs. Wulff and four children from her fourth grade class listen as reporter from Chula Vista paper interviews Dr. Reid MacDonald on children's find.

Mrs. Leona Wulff and children excavate around find. Directly behind Mrs. Wulff is Cindy Weichert, whose father's rockhunting experience helped in identifying material.

our lives to the excavation and study of fossil vertebrates, there is no excuse for such destruction.

This summer I spent three months working in and around the famous White River Badlands on a fossil collection expedition. During this time, I visited three localities which I have visited periodically for the past 15 years. Each of these had been systematically stripped within two or three days prior to my arrival, and at one of these localities the digging was done without the permission of the landowner, although the diggers had to go through his farmyard to get into the quarry area. When two stratigraphers from the South Dakota Geological Survey approached this party while they were digging, they gathered up their gear and ran, leaving a series of gates open behind them.

One day in some fairly inaccessible badlands south of the White River, we encountered a 4WD truck-camper from Oregon. This party had come in to "collect some skulls." They did not have permits from the Oglala Sioux Tribal Council, the Superintendent of the Pine Ridge Reservation, or the Bureau of Indian Affairs. Permission is required from each of these offices in order to explore or collect on tribal land in a reservation, and if the collecting is to be done on private land the written consent of the landowner must also be obtained.

From the above, one would almost get the feeling that I am against rockhounds, pebblepups, and the rest of that large group of hobbyists. This is not true; rather than fight them I'd much rather see them join us. It is from these outdoor enthusiasts that we get much of our scientifically valuable material and leads on sites which help us expand our knowledge of life in the past.

Fossil vertebrates are relatively rare. They do not ordinarily occur in large masses as do fossil plants or invertebrates. To collect most fossil vertebrates properly, a great deal of time, training and skill is required. Once collected, it is not a scientific specimen but just a curiosity unless the specimen is accompanied by complete geographical and geological data. It is because of frequent damage caused by the unthinking, the merely curious, or the avaricious that many of us do not publish locality descriptions in our scientific papers. This is a hindrance to other professional paleontologists, but it is the only way that we can protect our sources of scientific material from destruction and loss.

This introduction leads me to my plea for fossil vertebrates. Why can't the hobbyist join us in our search for knowledge and in the reconstructing of the history of the earth's buried past? Amateur collectors have been responsible for many of the important scientific finds here in California. A high school boy from Gustine led the University of California to several important finds of marine reptiles from the Cretaceous; a high school fossil club at Hayward, "The Boy Paleontologists," was responsible for the discovery of several important fossil sites in the San Francisco Bay area; a plumber from San Jacinto discovered the very important Vallecito Pleistocene fossil-bearing sequence in the Anza-Borrego Desert area and took members of this museum's staff to the site. Since he reported this discovery, a major effort has been made to collect from the area.

The results of this work will fill in a significant chapter of the history of southern California. The finder is now an honorary member of the museum staff as a research associate, he has had a fossil species named for him, and he has been invited to accompany me on two fossil-hunting expeditions which took him to the Lake Chapala area in Mexico for two months and to the famous fossil country of the Great Plains for three months. This amateur believes that specimens of scientific importance should be in museums and not in a box under the bed, in the woodshed, in the basement, or possibly cemented into the fireplace or fishpond. He feels that he has been completely compensated for his contributions by the enjoyment he has found in his close association with the museum and its staff.

Why not make sure that your finds are made useful to science? If you find a vertebrate fossil which is easily collected, bring it to a museum or university for identification. If this is impossible, send a photograph of the specimen and a description of the locality where you found it. The paleontologist you contact will be happy to identify your specimen, and, if it is of scientific value, will probably invite you to present it to the museum.

If the specimen is not collectible without special tools or knowledge, please don't try to remove it yourself. Take a picture of the specimen, cover it with paper and dirt so that it will be

Imperial mastodon skeleton, La Brea Hall, Los Angeles County Museum of Natural History.

Dr. J. Reid MacDonald, senior curator of vertebrate paleontology, Los Angeles County Museum of Natural History.

Posing for newspaper photos are Mrs. Wulff, Kevin Bailey, Tommy Holz, Loren Larson, student teacher Lemuel Lemmons, and Cindy Weichert. Photographer-reporter is Karl Hall of the Chula Vista Star-News.

Teacher and class here inspect skeleton of Antrodemus valens *in Los Angeles County Museum of Natural History.*

Pleasure and fascination are apparent on faces of children enjoying exhibits in La Brea Hall, Los Angeles County Museum of Natural History.

Special attraction at Los Angeles County Museum is this huge piece of dinosaur bone kept available for children to feel much as they might a piece of sculpture. Contact brings them physical experience to augment evidence of their eyes.

protected from the weather and hidden from less astute collectors, and send the picture to a paleontologist or take it in person. Don't be disappointed if the museum or university doesn't send someone to you immediately. Vertebrate paleontology staffs are always small and swamped with work, but all of us will give promising amateur finds the highest possible priority.

It may be that your discovery will be the beginning of a new breakthrough in scientific knowledge. You might have a new animal named for you, have the opportunity to join a museum on its expeditions, or be allowed to work in its laboratory. Here in the Los Angeles Couty Museum we have many volunteer workers who value the privilege of being allowed behind the scenes. Most of these fine people came to us originally through their interest in having the specimens that they found made part of the museum's collection.

Often, the museum will be able to make a plaster or plastic cast of your specimen which will be virtually indistinguishable from the original. This will be your memento of your contribution to science.

If you find a specimen which you would like to have identified or which you believe is of scientific importance (and most fossil vertebrates are of scientific importance), you should contact any of the following institutions. There is at least one vertebrate paleontologist at each of these places.

Dr. J. R. MacDonald
Los Angeles County Museum
Exposition Park, Los Angeles

Mr. Phil C. Orr
Santa Barbara Natural History
Museum, Santa Barbara

Dr. D. E. Savage
Museum of Paleontology
University of California, Berkeley

Dr. Richard H. Tedford
Department of Geology
University of California
Riverside

Dr. Peter P. Vaughn
Department of Zoology
University of California
Los Angeles

Dr. John A. White
Department of Zoology
Long Beach State College
Long Beach

How about joining us? We'd be delighted to have you with us.

NATIONAL HIGHWAY WEEK

Senator James A. Cobey of Merced, and District 10 Engineer John Meyer ride Mexican carreta pulled by members of Highway 33 Association, in celebration of opening of 25 miles of Interstate 5 in Merced County. Color guard was furnished by Manuel M. Lopes American Legion Post No. 240 from Gustine.

Posed for photo at dedication of A.S.C.E. award plaque at Donner Summit, on Interstate 80, George Langsner, Deputy State Highway Engineer, Paul Larios, assistant manager, Harrah's auto collection, and Clyde Gessel, director of District 11, A.S.C.E., in front of 1927 Stutz Blackhawk from Harrah's collection. In background ex-Directors of Public Works Fred Bagshaw and Frank Durkee look on.

District 11 Engineer Jacob Dekema rides shotgun on Wells Fargo stagecoach in San Diego county celebration of opening of 25 miles of Interstate 5. Girl is Frances Rooks and man beside her is Tom Hernandez, respectively "Miss Fairest of the Fair" and "Don Diego" of county fair.

National Highway Week will be observed this year from September 18 through September 24. In California, a group of prominent citizens have formed a committee under the chairmanship of Harrison R. Baker of Pasadena to advise and direct activities throughout the state. In addition, various organizations have banded together and will serve as statewide sponsors.

Baker cited the average Californian's affinity to his automobile as a prime reason why National Highway Week should be of statewide interest.

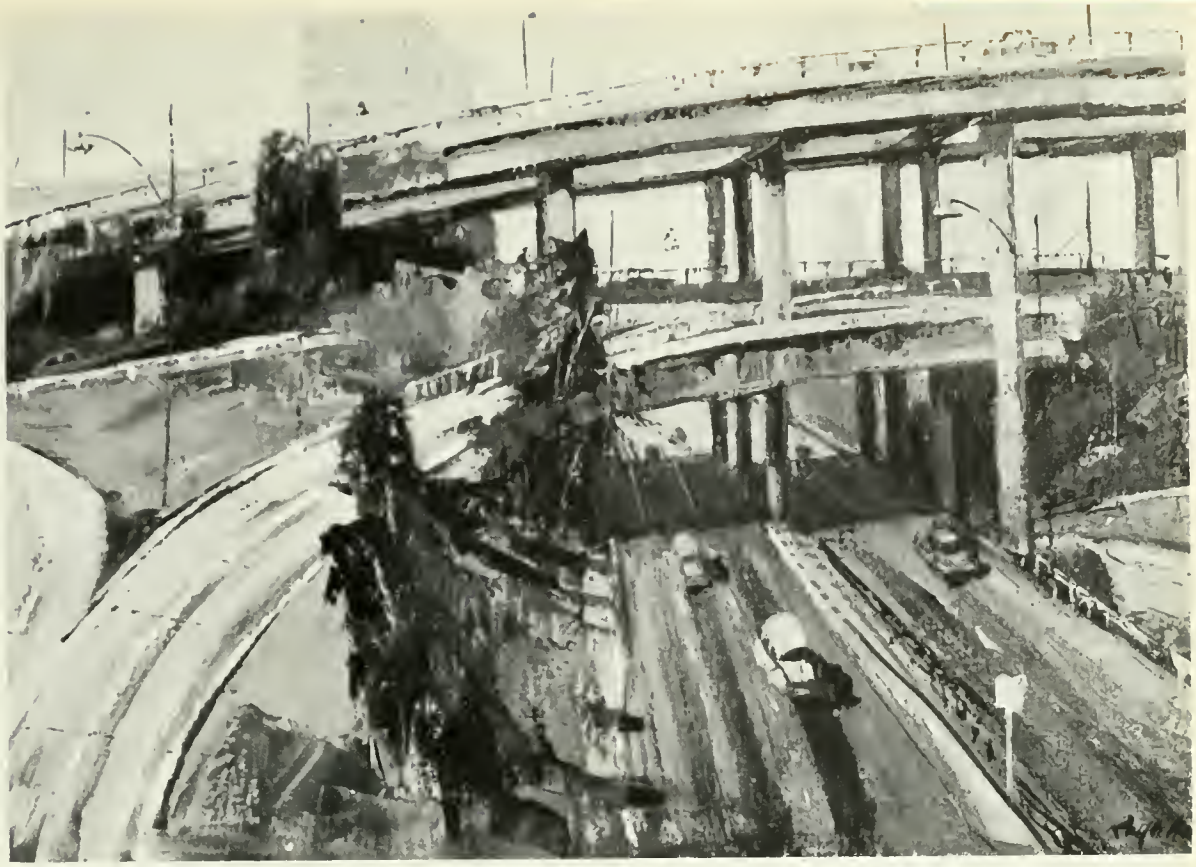
He pointed out that at this time the number of automobiles, trucks and buses operating within the United States has reached an all-time high—slightly more than 100,000,000. Of this number more than one-tenth (10,-500,000) are registered in California. The 3,500,000 located in Los Angeles County make that spot the world's vehicle population center for it is more than the number registered in any one of 45 states.

The need for additional city streets, county roads and state highways is obvious according to Baker, who told his committee that this network of California thoroughfares carried 96,-000,000,000 vehicle-miles of traffic last year.

"This is a fact that should impress our astronauts," Baker declared, "for a space ship would have to make 500 round trips to the moon *each day of the year* just to equal it."

Recently completed freeway construction that enhances the state highway system was lauded by Baker. He singled four in particular: first, a 25-mile stretch of Interstate 5 in San Diego County that opened to traffic in June; another 25-mile stretch of the Westside Freeway (Interstate 5) in Merced County that was completed recently; a section of Route 88 in Amador County that this year won first place in national scenic highway competitions; and, fourth, Interstate 80 from Sacramento to the Nevada State line, which was honored by the American Society of Civil Engineers. He also commented on the favorable impact the Collier-Unruh Act had had on city streets and county roads.

A number of events already have been planned as a part of this year's National Highway Week observance. Included are ground-breaking ceremonies for highway construction just ready to begin; dedication ceremonies for newly completed projects; exhibits in schools; county fairs and other public places; and landscaping projects by youth groups and women's clubs.



Ralph Hulett's painting of a section of the Four-Level Interchange in the center of the Los Angeles freeway system picks up powerful verticals and arching curves of dramatic structure.

freeways on canvas

BY ELEANOR N WOOD

Painting in background is of the Santa Ana Freeway and the Los Angeles Civic Center. Mr. Hulett here is working on more conventional desert and mountain landscape.

Los Angeles artist Ralph Hulett has a method for demonstrating graphically the role freeways are playing in the rejuvenation of his city: He paints them on canvas.

Hulett, who has just completed a series called "The Changing Face of Downtown," began painting the landmarks of Los Angeles in the 1930's during his days as a student at Chouinard Art Institute.

Feeling that the value of freeways as an art subject is often overlooked, Hulett has included several views of them to illustrate the dynamism of the metropolitan city.

In describing a painting called "Birth of Tomorrow," he says: "I call it that because the interchange signifies the cultural emergence of the city . . . the contemporary architectural face of it . . . the freeways converge on the cultural heart . . . the music center and all.

"The composition attracted me because of the dynamic forces . . . all these arterial thrusts working against one another . . . two being intersected by a third. It represents an interesting compositional problem."

Hulett, a color stylist with Walt Disney for many years, feels that we might pay more attention to the artistic values of freeways if we were less nostalgic about the familiar scenes progress erases.

In sympathy with those who feel sadly about change, Hulett notes: "I know how they feel because I've been sketching in the area so long. With so many of the landmarks disappearing it's like seeing old friends leaving. But freeways for the most part are beautifully wedded to their new surroundings. With the effort they put into landscaping they look right at home in a year or two.

"We're in the midst of a violent revolution—the new replacing the old. We miss our old friends but have to make new ones. And the freeways will be among them."

Honors accorded Hulett have included 23 awards in national and state art shows, including the *American Artist Magazine* citation.

He is a member of the American Watercolor Society, the California Watercolor Society, and a life member of the Laguna Art Association. He has had one-man shows in New York, Los Angeles, and San Francisco.

Because of the rugged terrain, a helicopter was used to relocate telephone poles around the Crestline Interchange. The chopper also brought in wire and other supplies. Photo by General Telephone Company.

CRESTLINE INTERCHANGE

BY TEK TANAKA

Imagine having to dig a 350- by 400-foot-wide ledge into the side of a mountain!

That was the problem facing the State Division of Highways in designing and building the Crestline Interchange in the San Bernardino Mountains. Some 330,000 cubic yards of rock and dirt had to be removed to make enough room for the two sidehill viaducts and two separation bridges needed to connect Highway 138 with the Rim of the World Highway (Highway 18) north of the City of San Bernardino.

A preliminary geologic study revealed a 25-foot-wide earthquake fault zone near the proposed location of the northeast off-ramp. As a precaution, the slope of the cut into the mountain was made shallower than normal and 20-foot-wide benches were set into it at 60- or 80-foot intervals to catch any debris that might be jarred loose by earth tremors.

The Crestline Interchange, completed in April, is the second in a series of seven contracts that will, within the next five or six years, four-lane all of Highway 18 from San Bernardino north to the interchange, a distance of 10 miles. Estimated cost of the seven jobs is $10,000,000.

Construction of the interchange presented several special problems which were solved by equally special solutions.

For example, the General Telephone Company's line which serves the Crestline-Lake Arrowhead region had to be relocated because the existing line interfered with a proposed highway embankment at Mormon Springs. The line crossed at right angles to the highway and continued up the face of the mountain. Holes were dug by hand for the new poles. A rigging and release device was attached to a heli-

Captain Seeley of Mormon Battalion Built First Road in 1850's

The City of San Bernardino was laid out by a colony of Mormons who settled in the valley in the summer of 1851. Within several years, the bench land near the base of the mountain north of the town had been brought under cultivation. Captain Seeley of the Mormon Battalion built the old mountain road leading up the canyon by Waterman's Hot Springs to the summit. The seven-mile road which made the mountains accessible to the early settlers was said to have cost $7,000.

The road was subsequently taken into the county road system. In 1917, it was acquired as a state highway by legislative action. The original alignment was used until the early 1930's, at which time portions were abandoned for more favorable routings. A portion of this Old Waterman Canyon route is being used as a detour for current construction. Two future contracts contemplate its further use.

The present highway, within the San Bernardino mountain region, is known locally as "Rim of the World Drive" and is the principal entrance to the Crestline and Lake Arrowhead recreational areas.

The original Route 138/18 separation underpass and connection was built by the county in 1931, and was taken into the state highway system in 1933.

The new interchange connects Highways 18 and 138 just south of Crestline in San Bernardino County.

copter. The poles were hung vertically under the chopper. The pilot, directed by a flagman on the ground, released the poles into the prepared holes. The cable was also flown in by the helicopter. The operation proceeded smoothly, except on one occasion when the release device let go prematurely and the pole slid and rolled to the bottom of the canyon.

In another instance, there was not enough room in the cuts for large earthmovers to maneuver. Dozers were used instead to push the material down to loaders which filled rock trucks. Most of the material was hauled one-half mile downhill to Mormon Springs, where it will be used in a future project to improve and widen the highway there.

During construction, the cut slope northwest of the separation structure was found to be unstable. A 333-foot-long retaining wall was built to hold back the loose earth and rock. However, conventional methods of forming and placing the wall appeared to be uneconomical because expensive temporary shoring would be required. In addition to expense, the hazard of slides would continually endanger the lives of the workmen involved in such an operation. There was also a definite need to speed up the wall construction in order to minimize the possibility of loss of the facility to public traffic from slides. It was decided to precast the wall and lift it into place. Fifteen precast sections 14 feet high and from 18 to 21.5 feet long were erected. An opening of one foot was left between sections and a closing pour was made at these locations. High-early-strength concrete was used in the wall sections so that they could be lifted into place two days after they had been poured.

The contractor, in sinking columns to support the interchange bridges, sometimes had to excavate to 100 feet below the surface before he reached bedrock. At most locations, suitable foundation rock was found at a depth of about 50 feet. Individual rocks encountered during the excavation operation had to be air hammered and hand removed. Larger rock masses near the column footings had to be blasted.

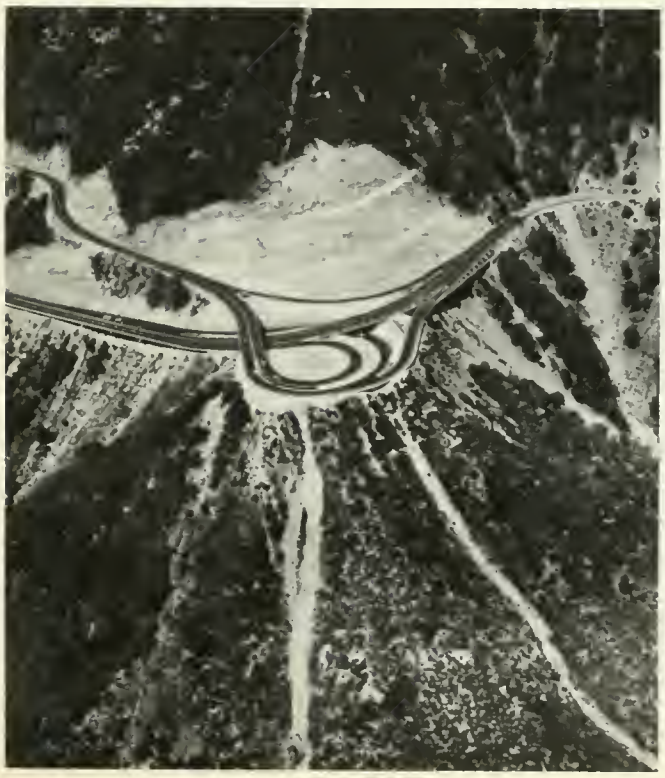
The workmen were lifted in and out of the holes in a cage which replaced the clamshell when handwork was to be done. Working room was reduced, and poor visibility became a problem as the crews burrowed their way deeper into the earth. In deeper holes, after blasting, the workmen sent down air compresser hoses to drive out the blast fumes but still had to contend with the compressor fumes which left a "smog alert" condition.

When it was possible, casings were driven into place by specially designed weights dropped by a crane. Recovery of the driven casings after completion of the columns and footings often was difficult. In one instance, more than two days were spent getting one casing out of the hole. The casing had to be cut from top to bottom and required the combined efforts of two cranes to dislodge it.

Traffic was allowed to travel through the project during construction except for one 10-day period when the road was closed during blasting and rock removal.

Numerous slides which occurred during the winter storms added to the problems and construction costs.

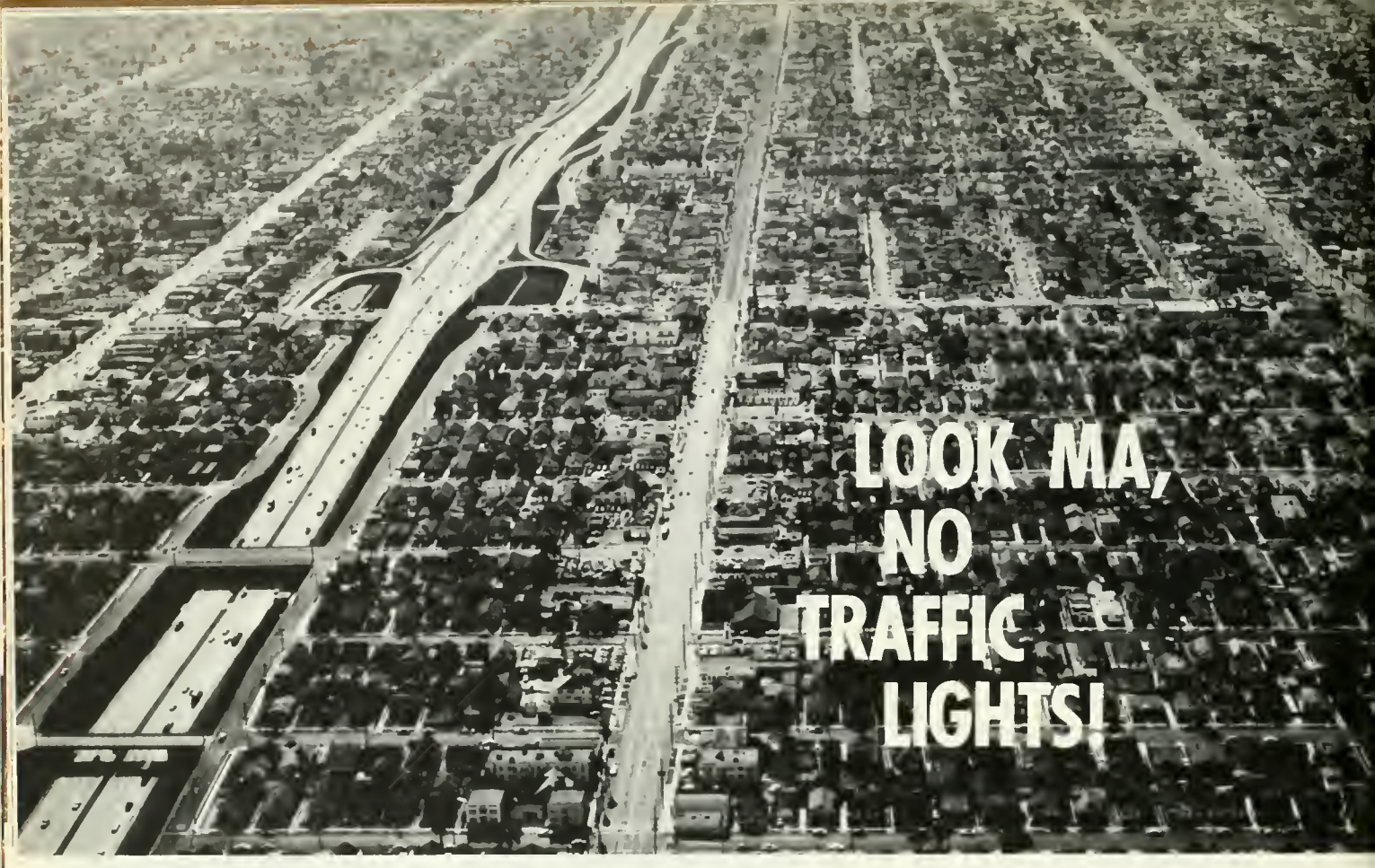
Considerable erosion control planting was done on the project. Spanish broom seed was planted on all cut slopes, and Spanish broom seedlings were transplanted at six-foot centers along all tops of cuts and fills and edges of benches. Alfalfa and brush poppy seeds were sown on bare slopes. Cedar trees were planted at various locations around the interchange to blend in with the natural terrain of the wilderness.



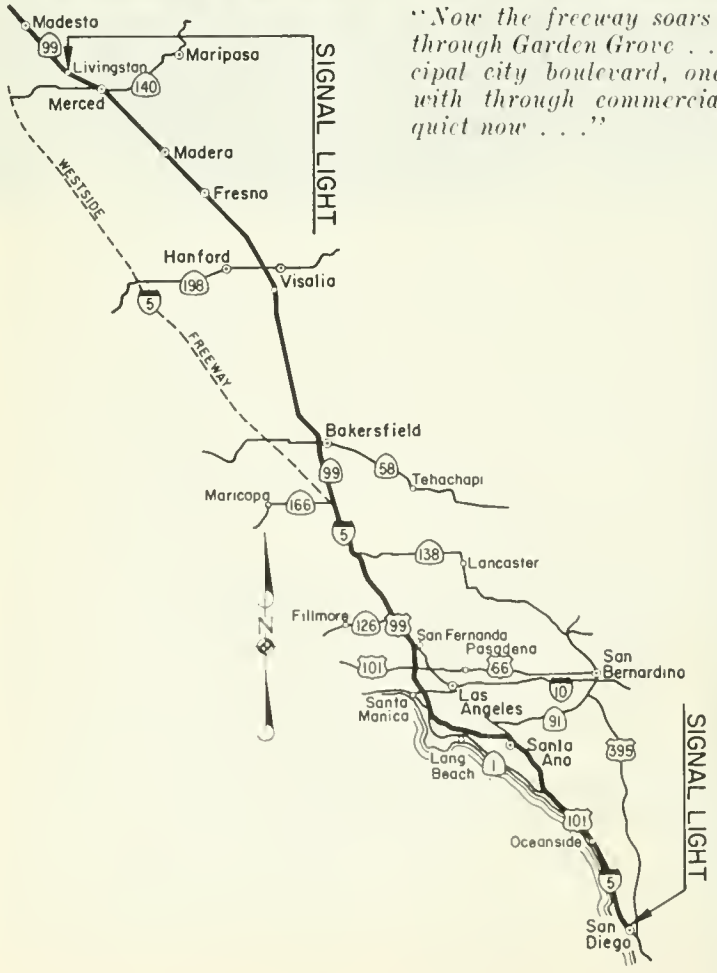
EVOLUTION OF AN INTERCHANGE.
Photo top—old interchange on the side of Mount Anderson before reconstruction.

Photo middle—a model of the proposed interchange before it was built.

Photo left—the completed interchange, a spectacular engineering achievement in treacherously rugged country.



LOOK MA, NO TRAFFIC LIGHTS!



"Now the freeway soars unhindered through Garden Grove . . . The principal city boulevard, once thronged with through commercial traffic, is quiet now . . ."

BY CHARLES F. GUSTAFSON

At Rosecrans Street and Pacific Highway in San Diego a clutch of morning commuter traffic is backed up behind the traffic light, waiting for it to turn green. But one motorist waiting there is not a commuter. He is headed north to get onto Interstate 5, backbone route of California.

Like the morning breeze, the motorist is cool. He waits with patience. He knows that on his journey north today through one of the land's great metropolitan areas, driving what's been called the world's busiest long-distance roadway, he will see no traffic signal again for more than 400 miles.

He will make his trip at legal speeds of up to 70 miles per hour. It will take him less time, probably, than his usual working day. He will pay no toll charges, though a similar journey on the parkways, throughways, or turnpikes of other states would cost him at least a cent a mile, and frequently much more. And he will enjoy a variety of scenery—urban, rural, industrial, agricultural, mountains, sea, and forest—that many a man spends a lifetime to experience.

The signal flickers green. The mo-

torist edges forward. San Diego, California's oldest city, is soon behind, and he is heading out over the broad highway past Mission Bay and La Jolla.

In the vicinity of Encinitas, Leucadia and Cardiff-by-the-Sea, he is a few miles inland, the old coastal route bypassed. Here near Encinitas (flower capital of the world, its citizens say), at Christmas, thousands of acres of poinsettias turn seaside and inland fields and hillsides red. Out of the corner of his other eye he sees the sparkling blue of the Pacific. Early California missions are near . . . wonderful beaches . . . a Marine Corps training camp throbbing with activity. Jet fighters scream overhead in practice sorties.

Just past San Clemente the highway swings inland to penetrate deeply into Orange County. The roadway threads miles of scented orange groves. Luxurious residential parks, golf courses, shopping centers sprout by the square mile in onetime bean fields. Yet there's room for one of the largest and most active working ranches anywhere, against the gentle rolling hills, green and dotted with grazing cattle, crowned with fleecy clouds in an unbelievable sky.

Ahead, Disneyland. The tip of its Matterhorn shows distantly over tall eucalyptus groves. Interstate 5 runs past its gates and onward . . . the vital artery to and through the industrial and commercial heartland of the City of Los Angeles.

But the driver elects to bypass this busy route. He chooses new Route 22 (Garden Grove) Freeway. Here, earlier this spring, the opening of a key section eliminated yet another traffic signal. Now the freeway soars unhindered through Garden Grove, said to be the fastest growing city in the fastest growing county in the United States. The principal city boulevard, once thronged with through commercial traffic, is quiet now, well able to serve the needs of local residents.

Route 22 merges quickly and smoothly into Interstate 405, the carefully planned metropolitan bypass called the San Diego Freeway. Los Angeles County, now. Off to the right and beyond the bustling Long Beach Municipal Airport are the blocks-long Douglas Aircraft facilities, home of the DC8s and DC9s (and the Dakotas and DC3s of fond memory). Then the slopes of Signal Hill, still black with the money trees called derricks, loom

ABOVE—". . . at Christmas, thousands of acres of poinsettias turn seaside and inland fields and hillsides red . . ." CENTER—"Just past San Clemente the highway swings inland . . ." BELOW—"But the driver . . . chooses new Route 22 (Garden Grove) freeway. Here, earlier this spring, the opening of a key section eliminated yet another traffic signal."

TOP—"Westward through miles of small cities and suburban areas . . ." NEXT LEFT— ". . . the San Gabriel Mountains rear high ahead." DIRECTLY ABOVE RIGHT— ". . . a four-lane expressway cuts through on a shorter path." LEFT—"following I-405 up through 'big cut.'"

ahead. Westward through miles of small cities and suburban areas, the local traffic is stopping and starting, inching its way on the surface streets below.

The roadway veers north again. To the right, Inglewood, where during the weeks of the Hollywood season the thoroughbreds run. The control towers of Los Angeles International Airport cut sharply into the sky. Each month more planes, more people, more cargo pass through this modern terminal, ringed by new hotels, new office buildings, new commercial facilities. The thriving southern California aerospace industry centers nearby.

Traffic constantly merges with and leaves the unhindered freeway stream at the many interchanges. A little farther north comes the separation whose sweeping curves and soaring connector roads have won national aesthetic awards. It's the Santa Monica Freeway (Interstate 10) interchange with the San Diego Freeway. Just a few miles beyond this point is road's end for I-10, of which the Santa Monica Freeway is a portion, but northbound drivers on I-405 sail swiftly through the maze of curving ramps.

A few minutes later the driver is following I-405 up through the "big cut" over the Santa Monica mountains, and then dropping down into the San Fernando Valley. Another ten miles and I-405 joins the Golden State Freeway with its familiar Interstate 5 symbol.

At once the San Gabriel Mountains rear high ahead. Ever since 1914, when a two-lane road wound a tortuous path for 48 miles up and around and over the spine of these rugged mountains, the highway through them has been called the Ridge Route. Today a four-lane expressway cuts through on a shorter path. Under construction, scheduled for 1969 completion, is the new eight-lane freeway, its curves and inclines gentled to permit a steady 70 miles per hour over the course that once took four days on horseback.

Near the Kern county line the road reaches an elevation of 4,200 feet in an area of rocky grandeur, lower slopes dotted with live oaks. Then it descends to the San Joaquin Valley floor via the spectacular Grapevine. Eight lanes and well pacified . . . but once this twisting precipitate path was the terror of the mountains. Hair-raising tales of the old road circulate whenever oldtimers gather. Now a novice can drive it safely, and if it's

spring can take time to enjoy the fields of wildflowers which spread below him at the viewpoints.

On the San Joaquin Valley plain, endless miles of cotton fields, ginning mills, and cotton warehouses slip past the straight, wide roadway. Just south of Bakersfield the even flow of the terrain and the superb highway design permit legal 70-mile-per-hour speeds for long stretches.

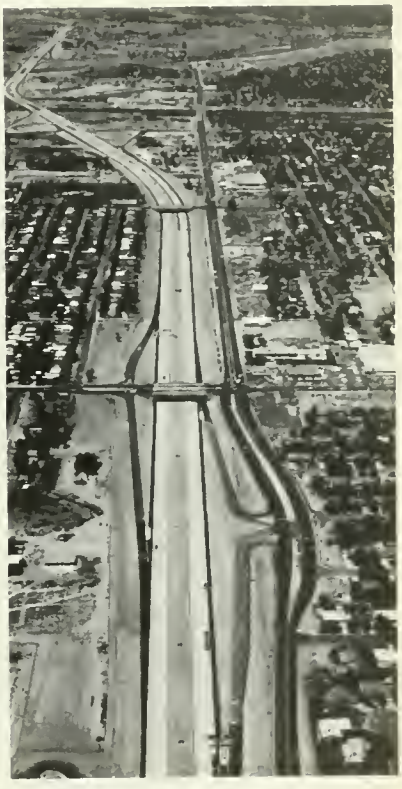
This wealthy agricultural domain continues into Tulare County. In the eastern haze, miles away across the level fields of crops and diagonally ordered orchard rows, the white peaks of the Sierra appear. Sequoia and Kings Canyon National Parks are up there somewhere, with all their wild beauty and many of the world's oldest and largest living trees. Looming over all, Mount Whitney, at 14,495 feet California's (and once the country's) tallest peak.

At Fresno an exit sign tempts with the road to Yosemite Valley. But the motorist presses on, with never a traffic signal to slow his steady progress. In this geographical center of California, vines and crops, pasture and rangelands sweep to the horizon in all directions. Across the San Joaquin River into Madera County, lumbering begins to come into its own. Mills and smoking beehives dot the distant landscape, for millions of board feet are cut annually on both private and government forest lands, rolling on the highway to their varied markets.

Thriving towns and cities, their local streets freed for local traffic, line the route of the freeway, which knits them all together into an unending pageant of scenes, blurring one into the next as the afternoon shadows lengthen.

Twilight comes in Merced County. In the pleasant little city of Livingston, on Route 99 at Cressey Street, the sun's last rays glint through the tree-lined street to touch the first traffic signal since morning.

The San Joaquin Valley evening air is warmer than the breeze at San Diego, 410 miles and seven and a half hours ago. And the signal glows red. The motorist, too, glows . . . with quiet satisfaction recalling the experiences of this relaxing day on the highway. For him, it has been a day free of traffic signals and traffic jams, free of stop signs and toll charges, on the backbone road of California.



TOP—". . . descends to the San Joaquin Valley via the spectacular Grapevine." NEXT LEFT—". . . the road reaches an elevation of 4,200 feet . . ." DIRECTLY ABOVE RIGHT—". . . the even flow of the terrain and the superb highway design . . ." DIRECTLY ABOVE LEFT—". . . vines and crops, pasture and rangelands sweep to the horizon . . ."

Seattle Public Library

OCT 17 1966

UKIAH TO BOONVILLE

BY BRIAN T. COLWELL

Pioneer fence built when redwood was easier to get than wire, still marks right-of-way.

The recent completion of the final contract to widen and improve an 18-mile section of highway between Ukiah and Boonville in Mendocino County has also marked the end of its career as a county road and its official adoption into the state highway system as Route 253.

The modern two-lane highway will serve as an important connector route between Highway 101 and Anderson Valley to the west.

Mendocino County began improvement of the route in 1952 under the federal aid secondary program.

It was added to the state highway system by the Legislature in 1963, although its final adoption as a numbered route by the California Highway Commission was made contingent upon the completion of the final improvement contract. This done, the commission officially adopted the route in March.

Special Challenges

Construction of this final unit offered special challenges to the contractor and the engineers.

The job crossed some of the most unstable terrain in the state. Consequently, as much of the road as possible was placed in a cut instead of on a fill to avoid placing additional material and weight on the extremely unstable foundations.

All embankment areas required stabilization treatment which included trench excavation, placing permeable material (gravel, etc.) and perforated metal drainpipe. In order to provide adequate stabilization during construction, excavation quantities had to be trebled over the original design estimates. Approximately two miles of underdrains were placed to handle ground water.

During the winter of 1964–65, heavy rains caused slides in all major excavation slopes in the project. Corrective measures consisted of constructing benches in the excavation slopes at the slip plane elevation, removal of the more unstable portions of the slides and additional benching to catch material from future sliding. In some cases, a work area was built so that maintenance forces could work off the traveled way when removing additional slide material.

Traffic Control

Traffic control was also a difficult problem. The contract allowed two-hour closures because of heavy grading next to and on the existing roadway. The times of the closures were well advertised in the local news media in order to keep to a minimum the inconvenience to local traffic which had been subject to delays during the construction season since the inception of the construction program on this route in 1952. Without a doubt, the local population breathed a great sigh of relief upon completion of this last unit.

Began in 1851

Route 253 began its existence as the Anderson Valley Trail in 1851.

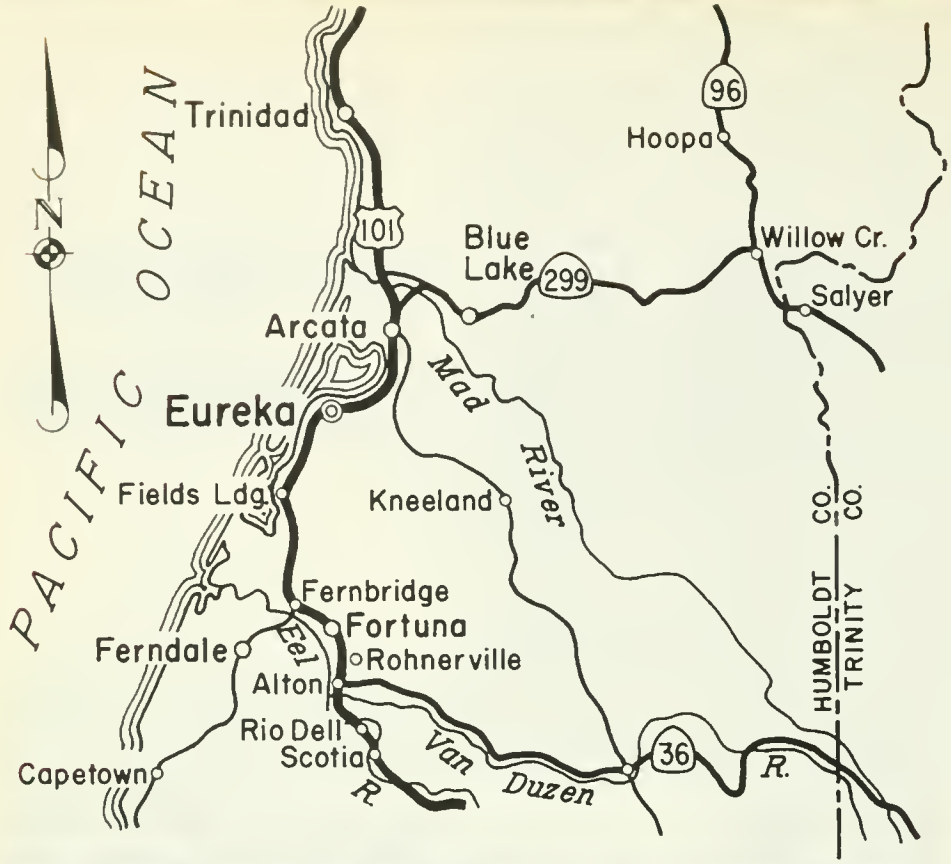
In 1868, John Gschwind got a bill through the State Legislature authorizing the Mendocino County Supervisors to grant the right to construct a toll road over the Anderson Valley Trail Route from Boonville to a point where the Anderson Valley Trail intersected the state road in Ukiah Valley.

The total cost of this first road was $10,000. The primary use of the road, known as the Gschwind Toll Road, was to transport lumber from Gschwind's Mill to Ukiah Valley. It continued as a toll road until the late 1800's and was incorporated into the Mendocino County system about 1896. A contract was let in 1896 for a 10-foot width of roadbed and a 35-foot minimum radius curve by the Mendocino County Board of Supervisors. This road continued on essentially the original location with minor improvements until 1952.

Highway 253, newly added to state system, is important east-west connection between Highway 128 at Boonville and Highway 101 near Ukiah.

PHOTO RIGHT—Because of unstable soil conditions as much of roadway as possible was built in cut rather than on fill to minimize weight on foundations. PHOTO BELOW—Some typical alignment of the new highway with some of old pioneer toll road visible by barn in upper right.

Mad River-Blue Lake Freeway



MAP LEFT—The new section of Highway 299 freeway extends from Highway 101 just north of Arcata to Blue Lake, crossing the Mad River on twin spans. PHOTO BELOW—The freeway follows the winding Mad River northwestward toward Arcata and the coast. In left foreground is the Glendale Overhead.

LEFT—Assistant State Public Works Director T. Fred Bagshaw speaks at the freeway dedication. BELOW—Industries on Parade lumber truck breaks ribbon officially opening freeway.

Y ERNEST J. REED, JR.

The new Mad River-Blue Lake Freeway in Humboldt County follows the river for nearly five miles, blending with the new timber growth, native flora and pasture lands. Special care was taken to contour all interchange areas, cuts and other construction to fit the surrounding landscape. Seeding of all cut and embankment slopes by helicopter has materially aided in healing what construction scars there were.

Twin structures carry traffic across the Mad River. Eastbound traffic uses the old bridge; westbound uses a new parallel span. Interchanges connect the freeway and Route 200, Essex Lane and Glendale. Return of traffic to old US 299 just west of Blue Lake was handled by building a portion of a future diamond interchange presently modified with temporary connections.

The new freeway is part of an extensive program to relocate and improve Highway 299.

Built at a cost of $6,200,000, it supersedes a portion of roadway rich in the history of Humboldt County.

First a game trail, then a footpath, was used by Lewis K. Wood and Dr. Josiah Gregg leading parties westward seeking a route from the upper Trinity River to the sea. Having descended the low coastal mountains, they picked up and followed the trail along the north bank of the river to a point just inland from its mouth. Here, after crossing to the south bank and marking the date, December 20, 1849, the two leaders became engaged in a violent quarrel. Unable to reconcile their differences, they named the stream "Mad" River. The parties split. Lewis Wood, known as the "old gentleman," moved south in search of Humboldt Bay. The Gregg party turned north to Trinidad.

By 1851 pack trains and livestock were moving along this trail to the settlement of Blue Lake, starting point for the rugged pack into the Trinity and Klamath area. Around the turn of the century the trail was widened by hand labor to buggy width and shortly afterward was improved to accommodate autos and trucks. In 1912 the Boards of Supervisors of Humboldt and Trinity Counties each appropriated $5,000 to improve it as a connecting link between the two counties.

Construction of the Blue Lake Interchange also required relocation of a half a mile of track of the Arcata & Mad River Railroad, the first and only relocation of track ever needed during the more than 100 years that the railroad has been operating. Built in 1864, the Arcata & Mad River is the oldest continuously operating railroad in California.

President Harold Hunt of Highway 299 Association receives hard hat award for his promotion of highway improvement in the north state.

Grand Oaks Study

BY

STUART L. HILL

AND

CHRISTOS BRIANAS

STUDY AREA. Interstate 80 looking northeast with Grand Oaks to the right and Antelope Road interchange in the foreground.

Typical study group homes. The truck in the background between the homes shows the proximity of the freeway.

Freeways and Private Property

Does a freeway adversely affect property values of homes right next to it?

This was the subject of a recent study by the Division of Highways Right of Way Department.

Result? The study showed that, even in a weak market, the freeway did not further weaken the potential market of properties adjacent to it.

Study Area

Two sections of a relatively new subdivision (Grand Oaks) on Interstate 80 some 16 miles northeast of Sacramento were chosen for the study.

Selection of the study area was influenced by the large number of foreclosures occurring there; one-third of the houses were foreclosed within a three-year period.

The Interstate 80 freeway through this area was completed in 1956. Houses in Grand Oaks were built by nine different contractors in late 1958 and 1959 in response to the rapid growth of the Sacramento area at that time. The subdivision was developed as a moderately priced neighborhood of smaller three-bedroom homes; 362 homes were built. Eighty-nine percent were FHA insured; the rest were veteran loans.

Initial prices of the homes ranged from $11,700 to $15,950; size from 850 to 1,200 square feet. Ninety percent of the homes had less than 1,100 square feet; 73 percent sold for less than $14,000.

The land around Grand Oaks is gently rolling so that the freeway varies from a few feet above to a few feet below the level of the adjoining lots, which are screened from the freeway by solid board fencing.

Study Procedure

The study covered all recorded transactions of the 362 homes (foreclosures, resales, original sales prices and terms, etc.) for six years, from mid-1959 to mid-1965.

The study compared foreclosure and resale figures of homes abutting the freeway and those not abutting it. In right-of-way parlance, an abutting home is one that joins the freeway right-of-way along a (in this case, the rear) property line. Of the 362 homes 44 abutted the freeway.

During the study period there were a total of 125 foreclosures including three homes which had two foreclosures each.

What were the findings of the study?

Findings

Did homes next to the freeway show a greater tendency toward foreclosure than those away from the freeway?

No. Thirty-two percent of homes next to freeway suffered foreclosure compared to 34 percent of the homes away from the freeway.

Were there any other location factors that showed a greater or lower foreclosure rate?

Yes, corner lots. They had a foreclosure rate of 38 percent and none of them were next to the freeway. On the other hand, homes adjacent to the school park (presumably enjoying a locational advantage) had a foreclosure rate of 17 percent.

Did homes next to the freeway foreclose sooner than homes away from the freeway?

No.

Did foreclosed homes next to freeway take longer to resell than homes away from the freeway?

Yes, about 10 months longer on the average.

Did the average home next to the freeway sell at a lower price than the average home away from the freeway?

Yes, but only three-quarters of 1 percent less. This is about $100 difference.

What size and price class homes showed greatest tendency to foreclose?

The smaller, less expensive homes.

Did original builders put different prices on homes next to the freeway and homes away from the freeway?

No.

Was equal financing available for houses next to and houses away from the freeway?

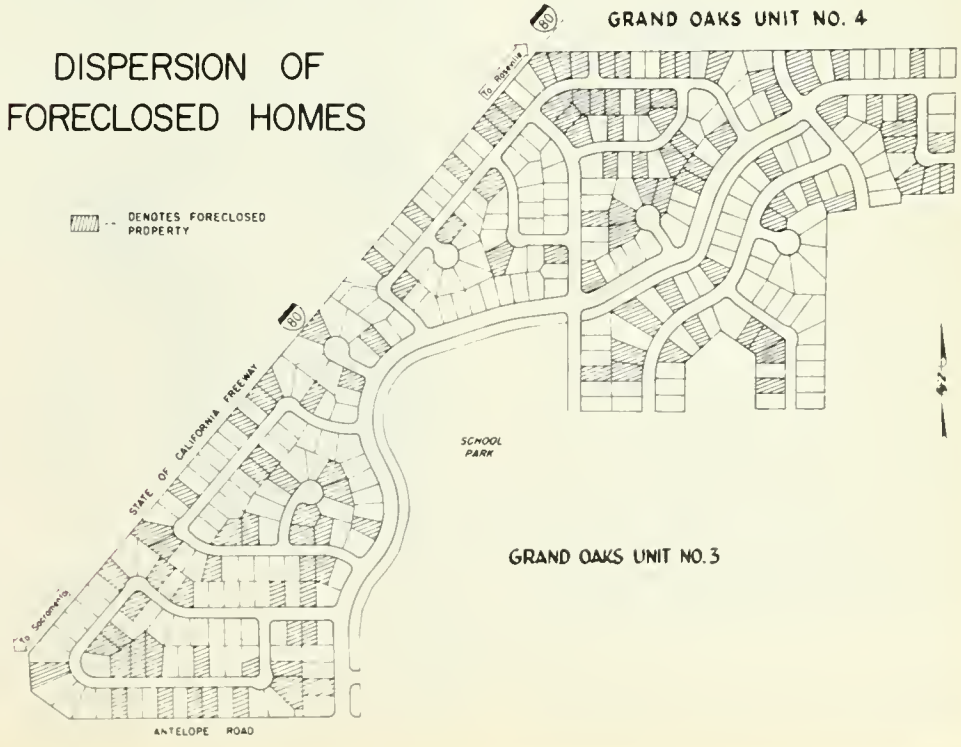
Yes.

What percentage of original owners still retain title to the properties in locations next to the freeway and away from the freeway?

A higher percentage of original buyers next to the freeway still own their homes.

(This article is based on a longer, more detailed study by the Division of Highways' Right of Way Department. Copies of this study can be obtained upon request.)

The shaded lots show that more than a third of the homes in the study area were foreclosed between 1959 and 1965.



Search for A Flagpole

As District 3 Engineer W. L. Warren looks on, Jack Snell (center) receives superior accomplishment award from Fred L. Jones, State Director of Parks and Recreation.

On May 26 Division of Highways employee John W. Snell received a superior accomplishment award for helping to find an old piece of a flagpole near Eureka for the Division of Beaches and Parks, although Snell works in District 3 in Marysville. The award, consisting of a certificate and engraved desk pen set, was given in person by Fred L. Jones, State Director of Parks and Recreation.

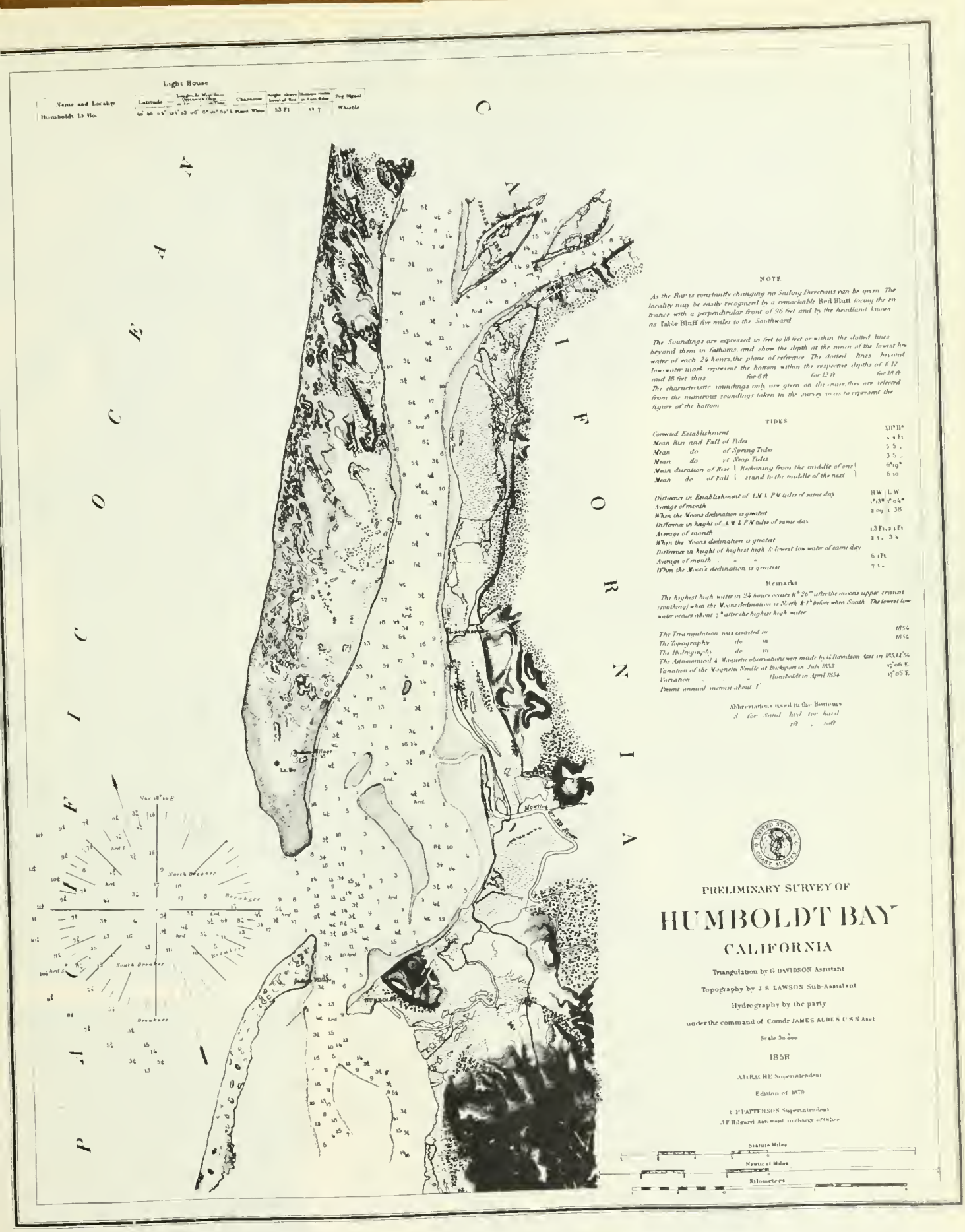
Snell, using his knowledge of survey methods gained in highway work, was told by Parks and Recreation personnel he saved the state at least $5,000 in archeological research, by finding a method for quickly and easily locating the point where the flagpole once stood at Fort Humboldt. Since the flagpole had been used in the original layout of the fort as a benchmark it was vital its location be established before any authentic restoration work could be begun.

Snell learned of the Fort Humboldt problem while working on a historical study of the old highway which once ran between Fort Sutter and the Coloma Saw Mill. During this study he became acquainted with Alan Welts, state park historian. In a friendly conversation, Welts explained the land at Fort Humboldt had been so intensively farmed in the years since the site was abandoned that it was almost impossible to find reference points, and it looked like the only way to find any was going to be by excavation.

Since Snell is a specialist in retracement research, the problem intrigued him. As soon as he had an opportunity he visited the State Library. Sharon Pfennighausen, of the Government Publications and Maps Section, became interested in the problem also.

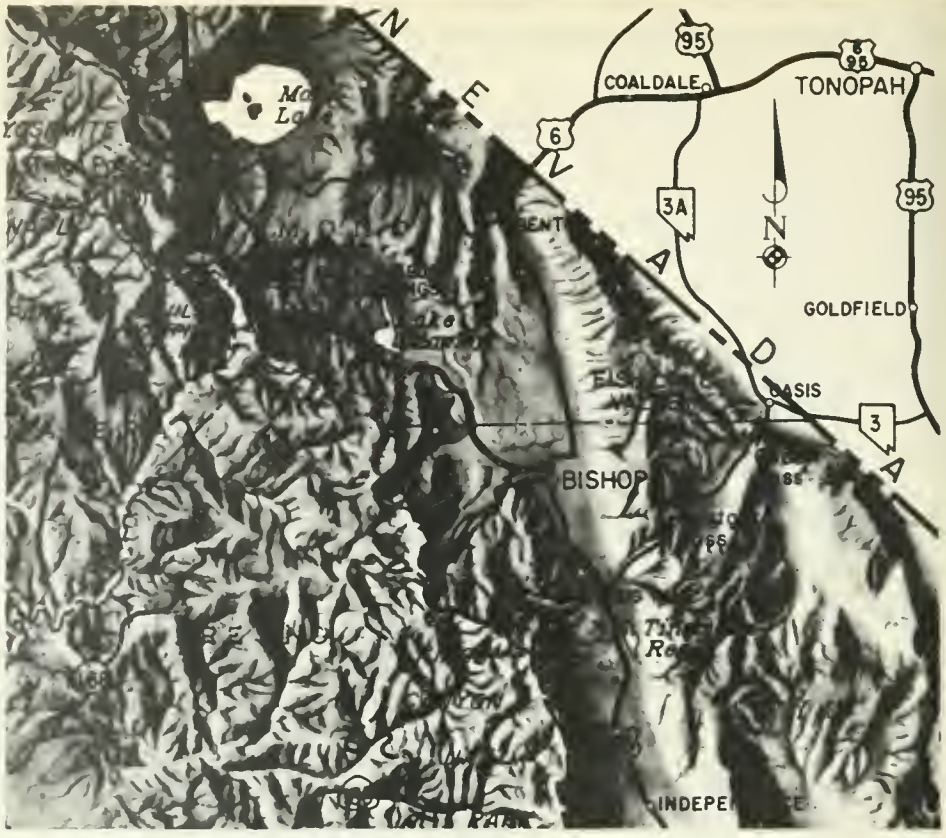
Snell, a merchant marine navigator during World War II, decided the flagpole must have been a navigational mark in early sailing directions for Humboldt Bay, and, after considerable work, Miss Pfennighausen found several early charts which were contemporary with the fort. The field notes from which the charts were made indicated the flagpole was used for sights. From this point on, location of the flagpole was merely a matter of reverse triangulation.

Of his achievement, Snell says modestly: "There is nothing unique or 'backwards' about replacing a destroyed monument from others in a control net. Surveyors all over the world have been doing it (while cursing and muttering dire threats) every day for more than 4,000 years. Even the curses have Biblical precedent, if not approval. Deuteronomy 27:17 says: 'Cursed be he that removeth his neighbour's landmark.' If you know the direction and distance from here to there, the same distance in the reverse direction ought to get you from there to here. Beaches and Parks personnel found the old flagpole base within 20 inches of the retraced position."



Beautifully detailed map made by U.S. Coast Survey in 1858 shows location of Fort Humboldt on east side of bay on bluff commanding bay entrance.

Oasis to State Line



ABOVE—Route leaves US 395 at Big Pine and traverses Westgard and Gilbert Passes. BELOW—Photo made as road drops down into Owens Valley. Sierra Nevada in distance is portion just east of King's Canyon National Park.

The California Highway Commission in October 1965 took into the state system a small section of county road in eastern Mono County—"Oasis to state line." Although only a little more than seven miles long, its adoption calls attention to a little-known part of the state for those who are exploration minded.

Designated State Route 266, it is one of the shorter numbered routes in California, but at its Oasis end it connects to the eastern part of Route 168, which in turn connects to US 395 at Big Pine.

Hot and dry in summer, Route 168 is best in the off season, although in winter it may, under rare circumstances, be closed by snow or flooding. The road traverses wild and barren country, almost untouched by man, crossing two summits on its way to the Nevada state line, and offers a pleasant little loop trip beyond the state line into an interesting section of Nevada.

Route 168 has a very low average daily traffic count. Nevertheless, although somewhat narrow in places, it is well maintained and perfectly safe for the careful driver.

The turnoff is plainly marked at Big Pine. Once you leave the town you start to climb almost immediately and cross the southern end of the White Mountains via Westgard Pass, elevation 7,271 feet. A feature of the trip is the very narrow canyon the road passes through near the summit, ideal as a setting for a western movie holdup or Indian ambush.

Near the summit there is a small plateau, with a road turning north into the higher ridges of the White Mountains and the now world-famous groves of bristlecone pines. We are told by scientists that some of these twisted, gnarled, and battered trees, surviving above 10,000 feet on the higher peaks of the range, are nearly 5,000 years old—the earth's oldest living things.

A mile or two farther east there is a curving, swooping descent into Deep Springs Valley, interesting as an ancient lakebed surrounded by burned and blackened mountains, across which the road travels in a straight line. Beyond this valley is another low, gentle pass, Gilbert Summit, with a

Large sign marks turnoff to Bristlecone Pine Forest.

ooking east along Route 168 into Deep 'prings Valley.

At Nevada state line Route 266 becomes Nevada 3A. Vehicle is Nevada highway maintenance patrol.

View is westerly, approaching Gilbert Pass.

View looking west from Gilbert Pass is magnificent, with Sierra Nevada in far distance, and White Mountains in front of them. White line in upper left is Route 168, and Deep Springs Highway Maintenance Station is located inside angle.

eries of interesting views of beautiful esert scenery, then another descent nto Fish Lake Valley.

At Oasis, with its ponds of water n the middle of the desert, you can urn south and continue on 168 into Nevada, or turn north into Nevada ia newly acquired 266, along the astern base of the White Mountains, etting a different view of this range. 'or those interested in making a loop rip, either of these routes connects vith Nevada state routes, and thirty niles or so further along, joins with JS 95 in Nevada, which passes hrough both Tonopah and Goldfield.

Sign at Westgard Pass dates back to 1916 "good roads" movement in California. A. L. Westgard, pioneer motorist and auto association official, urged route be incorporated into transcontinental Lincoln Highway.

Above: Full-scale model car with detachable forward pod.
Below in sequence downward: Laboratory car on test track. Section of BART test track near Concord. Artist's concept of aerial transit structure. Interior of model car. Attendant's seat for monitoring automatic control. (All BART photos.)

Commuters in electric trains and commuters in autos will be speeding down some of the same rights-of-way when the San Francisco Bay Area Rapid Transit system is finished in mid-1971.

Over about a quarter of the mileage of the new BART net linking San Francisco with Oakland and the East Bay, tracks for the high-speed, high-capacity trains will be in the freeway divider strip or on land alongside.

This cooperative use of land, where it is practical and where studies show that auto and train routes coincide, will mean direct savings of about 70 million dollars to BART.

And while it required the California Division of Highways to spend substantial sums much sooner than highway traffic demand alone would have dictated, it may mean long-run savings for the highway program in view of rising land and construction costs.

Coordinating the planning and financing of two limited-purpose agencies is not as simple as it may sound, because the division has no direct, legal obligation to do anything about railways, and BART is not directly charged with any responsibility for freeways.

But with close to 90 percent of California's people living in or near cities, there is arising a pretty obvious need to put all California's transportation brainpower to work on metropolitan congestion.

While highway engineers and railway engineers have worked opposite sides of the street, they are in the same business—that of providing for the movement of people and goods without which modern civilization cannot exist.

And so the Division of Highways and the Bay Area Rapid Transit District are pioneering a concept of cooperative land use that will save taxpayers millions and may contribute significantly to relieving the traffic congestion that impairs mobility in our cities.

The agreements between the two agencies for placing BART tracks in 3½ miles of the dividing strip of the Grove-Shafter Freeway in Oakland and in 6 miles of Highway 24 Freeway between Orinda and Walnut Creek have been reached long since and work on these joint ventures is well along.

In San Francisco another main travel corridor will eventually be shared, with BART lines running for about 2½ miles alongside the Southern Freeway. In southern Alameda County, the line will be laid alongside 238 freeway for about five miles.

These agreements as well as those covering joint land use by Interstate 5 and the California Aqueduct in the San Joaquin Valley will serve the Division of Highways as guideposts in metropolitan areas where rail rapid transit is under serious discussion.

In reaching these first agreements, he engineers from both agencies had o consider how the costs could be hared, how freeway and railway de-ign could be modified to get the best se of land at the least cost in money nd disruption, how design and con-truction schedules could be coordi-ated and how construction could be lovetailed for rapid completion of oth systems.

The Grove-Shafter was actually nderway before BART won the ond financing that made its transit et a practical reality. Here the high-vay people held up on their timetable nd later revised their engineering to ive BART time to plan its route in he divider strip.

On Highway 24, BART's decision o put tracks in the divider prompted Highways to speed up its planning nd build the freeway to eight lanes nmediately instead of in 1975.

Under the Grove-Shafter agree-ient, the division buys right-of-way, designs the freeway and the railway roadbed, and supervises construction, and BART pays as its share of engineering and inspection costs an amount equal to 10 percent of its share of construction costs.

In the same proportion as they share the right-of-way, BART and Highways share the cost of clearing and grubbing, embankments and retaining walls, streets over or under the joint facility, structure abutments and wingwalls, drainage and other utility structures, detours and traffic maintenance, and items already built by Highways before the agreement.

The two agencies share equally in the cost of frontage roads and freeway fencing and landscaping.

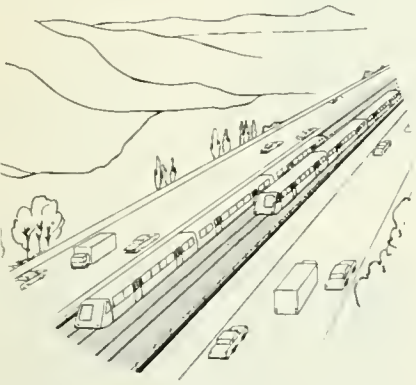
BART pays all additional costs involved in building the highway on an elevated structure where earth fill would have sufficed for freeway needs; of a median barrier where Highways would merely have installed a chain-link fence; of highway signs installed at BART's request; of entrance and exit structures where Highways contemplated only an embankment, and of other structures required solely because of the presence of transit facilities.

BART also pays the cost of pier foundations built before the agreement and not usable in the joint facility.

These are the nuts and bolts of joint action on the traffic problem by two agencies set up basically to deal each with its own phase of transportation.

Such action means reducing the amount of property needed in an area where the lay of the land leaves narrow corridors, providing convenient interconnection between two forms of transportation, and shortening the time of community disruption by building both facilities at the same time.

It may be the pattern of the future.



bove: Artist's concept of trains op-rating on freeway median. Below: ection of Highway 24 at Orinda, here trains will run in median of ighway.

Right above: Artist's rendering showing trains operating through tube beneath San Francisco Bay.

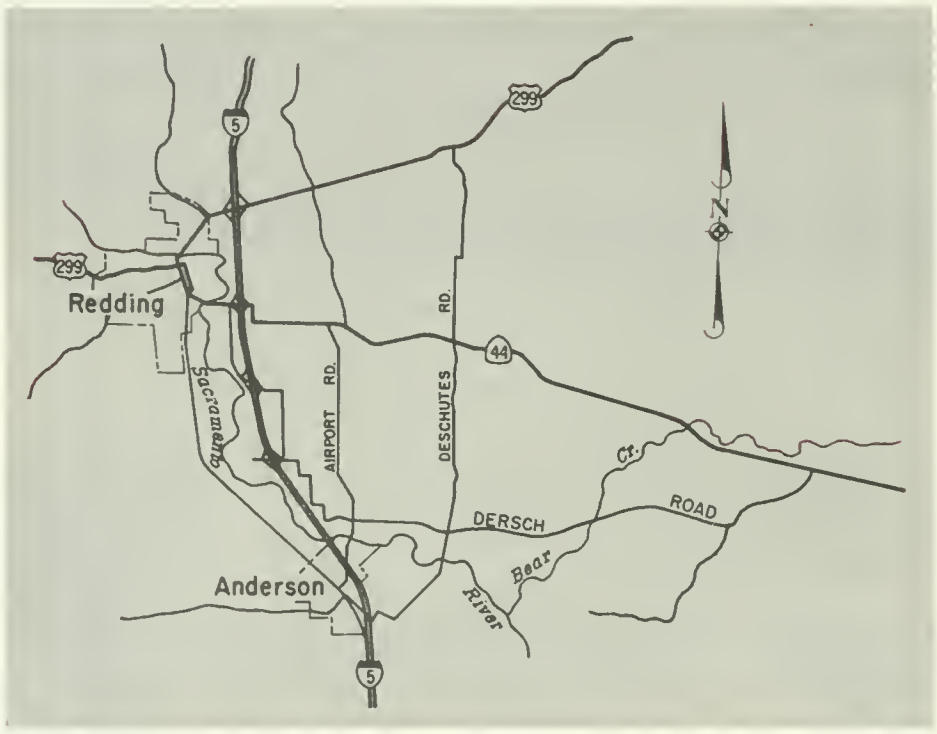
Right center: Artist's rendering of cutaway section showing various levels to be constructed beneath Market Street in San Francisco.

Right below: Various phases of construction include temporary tower to lay twin-bore tube, caisson, and tube sections being lowered.

Segment of aerial transit line built near Walnut Creek as test track.

Embalmer Builds Bridge

BY DONALD D. CHAMBERLAIN



In 1860, George Dersch, and his blind brother Fred, with his family, settled near the head of a beautiful small valley at the confluence of Bear Creek and Lack Creek. Six years later, at a time of great unrest between the settlers and the Indians of northern California, a hostile band of 15 Indians approached the home of the Dersches.

Unsuspecting the presence of the hostiles, Mrs. George Dersch walked outside on a routine chore and was shot down from ambush. Ten-year-old Fred, who had been working with his uncle in the orchard, ran to his mother's assistance, shouting at the Indians. Perhaps they had no more ammunition, but the aborigines saved face by throwing a few rocks, and then left. Although the location of only one of several attacks by "Digger" Indians at this time, the place of Mrs. Dersch's murder is known today as the site of the "Bear Creek Massacre."

Almost 100 years later, near this same point, community leaders celebrated the completion of 13 miles of reconstruction of "Dersch Road," FAS 1350. This road serves an important economic role in Shasta County as the primary route between vast public and private timber holdings to the east, and the lumber-processing area lying along the Sacramento River near Anderson. It also gives access to the recreational areas of Lassen Volcanic National Park, the Lassen National Forest, and the fabulous Hat Creek area, as well as Burney State Park and the general northeastern California recreational area.

Adoption of Shasta County's first five-year federal aid secondary program by the board of supervisors in 1959 authorized the project. Initial work consisted of obtaining basic topographic data, produced photogrammetrically under contract let in March 1961. Approximately 13 miles

Acrial view of country through which Dersch Road travels.

Between Deschutes Road and Highway 44, Shasta County.

was flown with maps submitted on a scale of 1″ to 50′ horizontal and 1″ to 2′ vertical, with a basic ground control set by Tellurometer and related to the California coordinate system. A complete set of individual photographs, a photo mosaic, and a pencil manuscript on chronoflex topographic map were submitted by Clair A. Hill and Associates at a cost of $1,280 per mile.

First work was completed in 1962 when the Upper Lack Creek Bridge was constructed at a cost of $28,994 entirely from county funds. At about the time this bridge was completed, the first federal aid secondary contract was let by the Division of Highways for a 5.3-mile stretch commencing at the easterly end of Dersch Road. The Division of Highways furnished the best information available at the time for the future route of Highway 44, leading from Redding to Lassen National Park. The project commenced at that point, running southwesterly. A ½-mile section between the beginning of the federal aid secondary work and Highway 44 was reconstructed on existing alignment by county forces to serve the interim period of some 5 to 10 years prior to construction of this section of Highway 44.

The initial federal aid secondary portion was constructed at a cost of $405,066 and was completed in December of 1962. The second unit commenced in early 1963 and was completed in December 1963 for a total length of 4.6 miles and at a cost of $402,119.

The following spring, 1964, a second contract for bridge construction was let by the County of Shasta, using local funds, for the construction of bridges across Lower Lack Creek, Dry Creek, and Bear Creek. These bridges were constructed of monolithic concrete T-beam after alternate bids ruled out use of precast concrete sections. The three bridges were completed at a cost of $11.12 per square foot for a total of $146,164 in September of 1963.

It is rather interesting to note that the bridge across Bear Creek, in the very near vicinity of the massacre of 100 years before, was constructed at a cost of $77,600. In the records of the county, a bridge was constructed across Bear Creek at the same point in 1903 at a cost of $975. The firm submitting the bid was the Anderson Furniture Store, who listed on their letterhead, among other things, that they were also undertakers and embalmers. This is the only time in history that we know of that a mortician has constructed a county bridge.

Following completion of the bridgework in 1964, a final FAS contract was let to Norman L. Fadel, Inc., for the remaining 2.2 miles of road. This contract also included the replacement of an old single-lane steel-truss bridge across Cow Creek. A major portion of the cost of this contract was the new bridge which is constructed of single column, Y-type bents with an open U-box girder span. The bridge substructure is footed on piles.

The roadway section has two 12-foot traffic lanes with four-foot shoulders. The basic thickness of 0.5-foot class 3 aggregate base was used throughout the project with variable thicknesses of subbase depending upon basement soil characteristics. Surfacing is of 0.2-foot asphalt concrete. Excavation was avoided wherever possible, because of the geologically recent volcanic extrusions which are overlain by very thin soils. Generally the road profile through the gently sloping lava areas was placed about 18 inches above the existing surface.

Various views of remodeled road as it is today. Note outmoded through-truss bridge common 50 years ago.

Interviewers must get information on travel patterns for all members of family. Husband is holding a card on which he listed the previous days' trips, as interviewer records the information on a detailed form.

ORIGIN AND DESTINATION STUDIES

When engineers speak of the application of Newton's law of gravity to people's travel habits, they don't mean people tend to take the downhill route as the easiest! They mean that people's travel habits follow the same pattern as Newton's law—those points close by exert much greater attraction to people free to travel than do those places farther away, just as two planets close to each other exert more attraction each on the other than do two far apart.

If you think about it, there is nothing very earthshaking about such a discovery. All it really says is that people more readily make short trips than long ones! The value of the discovery is it can now be reduced to a mathematical formula and used to predict travel needs.

This "gravity" law is just one of the things which have been learned from the ever-growing use of the "origin and destination study." The study is one of the most important tools in use today by planners who are seeking to make the best use of land and facilities in our ever-growing urban areas. Although conducted by highway engineers, the data is obviously of value to many other professions. A good study, if acted upon, enhances all community values.

The origin and destination study has come into use since World War II, and California has been a leader in its development. The San Francisco Bay area study of 1946–1947 was one of the first in the United States. The Sacramento study of 1947–1948 was another pioneer effort, and from these two were developed definite methods of approach in our state.

Since those years, the Federal Bureau of Public Roads has taken an increasing part in the studies, gradually establishing firmer guidelines. With passage of the legislation of 1962, the federal government now exercises strict control over the way the studies are conducted.

This most recent legislation encourages all cities or urban areas of 50,000 people or more to have such studies made, to insure allocation of federal funds for transportation. In California there are 13 such urban areas: Los Angeles-Long Beach; San Francisco-Oakland; San Diego; San Jose; Sacramento; San Bernardino - Riverside; Fresno; Pomona-Ontario; Bakersfield; Stockton; Santa Barbara; Oxnard; and Salinas. It is interesting to note that Texas has 22 urban areas—almost twice as many as California—but in the 22 are included many towns of less than 100,000 people, such as San Angelo, Texarkana, and Midland.

All told, the 22 Texas urban areas contain only 5 million people, whereas California's 13 areas contain 12 million. Obviously, California is now an urban state, with its people tending to concentrate in ever greater urban complexes. The extent of this urbanization is further emphasized when it is noted all the western states outside California, including Hawaii, have only 15 urban areas among them, with a total population of 5 million.

Less than 30 years ago an agricultural state, and, as we have seen, now urbanized in some areas comparable to

Interviewer has been given portion of carefully selected sample and is now checking area sample families live in to plan her route.

All interviewers carry identification cards including their photo, and must present them on arrival at home.

the crowded East, California is beset with dozens of problems. Schools, parks, hospitals, water supply, highways and streets—all must be expanded rapidly to deal with the state's population explosion.

However, since tremendous expenditures of public funds are involved, these new facilities cannot be added haphazardly as they once were, and the need for accurate data for planning is obvious. The O/D study is an important part of this planning.

Although on the face of it such a study would appear to be involved only in analyzing and predicting travel needs, road and street networks are of tremendous economic importance, and their placement will certainly be vital in developing the pattern of economic development of an urban complex. Conversely, to locate transportation routes without considering the economic forces at work in the community would be folly. This is why an origin and destination study today investigates a wide range of factors affecting the community or groups of communities.

In practice, of course, the investigating agency does not interview every person living in an area. Instead, carefully selected samples are taken, and in the personal interview stage only a limited number of dwelling units are chosen.

Personal interviews in the home are concerned only with the collection of data on travel habits of the members of the household. The information is used merely to add to a supply of statistical data, and no names are recorded, hence there is never any invasion of the individual's privacy.

The Bureau of Public Roads' "ten commandments" for the subjects which must be considered are: (1) economic factors affecting development; (2) population studies; (3) land use; (4) transportation facilities including those for mass transportation; (5) travel patterns; (6) terminal and transfer facilities; (7) traffic engineering features; (8) zoning ordinances, subdivision regulations, building codes, etc.; (9) financial resources; (10) social and community value factors.

Each of these factors is studied in considerable detail. Because of the great variety of subjects for this work, the Division of Highways employs, in addition to its engineers, experts in fields such as economics, statistics, and real estate.

In subject 1, "economic factors," for instance, there must be analysis of employment data by industrial category, per capita income, income-consumption patterns, car ownership per capita or household, plus intelligent forecasts for the future.

Population studies, as might be expected, entail forecasts of population at specified times in the future, in order to use the figures as indicators of future travel patterns. These figures are only one set of factors, however, as the travel habits of people change, and a mere interpolation of future figures from today's would be futile. Population studies then, must include all the historical data obtainable on population, patterns of growth, and an analysis of those factors which will affect population densities. The development of the motorcar itself, with its tremendous extension of the worker's mobility, has had profound effects on urban population density.

This revolution occasioned by the motorcar has likewise affected land use, the third point to be studied. The freedom and flexibility brought to transportation by the automobile broke up the old pattern of population concentration close to areas of heavy employment. Suburbs, once the zone of the well-to-do, came within reach of most workers. This not only used much more land for dwellings, but, because the new pattern had fewer homes to the acre, public transportation became more expensive to operate.

In the same vein, the automobile affected freight movement and shopping habits. Trucks became important in freight handling, particularly for short hauls, and ease of truck movement became a factor in location of industrial activities. Shopping centers with great parking spaces sprang up around the city's perimeter, eventually challenging the traditional downtown shopping districts.

In any inventory of transportation facilities, not only must the number of automobiles be taken into account, but also the freedom with which they may be used. Are existing routes congested? Do they travel in the direction of heaviest demand, or is the congestion made worse because drivers must use circuitous routes? Are more freeways and expressways needed? Are existing streets controlled to handle traffic efficiently to full capacity?

What public transportation systems are present? Are they well managed? Is use increasing or declining? If increasing, will increased income mean better service which in turn will affect private vehicle use patterns? If decreasing, can the opposite effect be expected?

Subject (5), travel patterns, requires both roadside interviews and home interviews. This means literally a study of all trips made by a selected

Prior to being allowed to go out and meet the public, interviewers get stiff training course in work they are to do.

tudy group, broken down into truck rips, taxi trips, auto driver trips, work rips, and any other category of value or analysis.

Subjects 6 through 9 are self-explanatory. They all pertain to those hings in the community which might ıinder or help the development of the :ommunity, or, more important, its levelopment in one direction rather han another.

Subject (10), social and commuity value factors, is a difficult one in hat much of it is concerned with maerial of a more or less intangible naure. Existing environmental factors uch as parks, open space, and recreaional facilities must be considered, as vell as space for the provision of such dditional features of this type as night be needed in future years. Presrvation of historical sites and buildngs also should be included in this art of the study.

Careful consideration must be given o the existence of ethnic group disricts, school, fire, park, and other spe-ial districts, and all the special govrnmental and local divisions which night have been created. Improvenents in traffic facilities must be made vith as little damage as possible to uch districts and facilities.

It is obvious that the job of planing improvements in our current urban patterns, be they to provide waer, electricity, or transportation, is a lifficult and complex problem. In planning improvements to transportaion, the origin and destination study as proven the best guide yet devised o provide information on present and uture needs.

TOP PHOTO—Heart of study is computer which takes information, organizes it, stores it for future availability, also makes it currently available in usable forms. BOTTOM PHOTO—Although computer does much of organization of material, considerable clerical work is necessary to code information for machines.

BY VERNE L. DAVIS
AND HOWARD CARTER

MERCED CITY-COUNTY JOB

Cooperation among several public agencies has resulted in removal of critical street deficiencies in and north of the City of Merced. Federal, state, county and city governments joined forces and funds to improve G Street and Santa Fe Drive between 27th Street in Merced and Route 59 northwest of the city. Both streets were transformed from highly congested two-lane roadways into four-lane, divided major arterials which will serve the rapidly growing Merced area for many years to come.

G Street is an important connector route for the city to many nearby recreational areas for picnicking, golfing, hunting and water sports. Merced High School and Merced Junior College both are located next to Santa Fe Drive, which also carries traffic to Castle Air Force Base, a large Strategic Air Command facility seven miles from Merced.

The project also included construction of a new bridge across Bear Creek.

Enough right-of-way was acquired so that the project can be widened to six lanes should the future traffic load require it.

The county portion of the $400,000 job was constructed and financed under the federal aid secondary highway program, the city portion under the FAS urban extension program.

NEW AND OLD. Photo above—the new, four-lane, divided section of Santa Fe Drive from above G Street and looking west. El Capitan High School is to the right. A portion of Merced is visible left background. Photo right—the old, two-lane highway looking from approximately the same spot as the photo above.

Much of the new freeway is through an area that will be developed as a green belt of parks, picnic areas and riding and hiking trails.

STEVENS CREEK FREEWAY

BY ROBERT N. KELLER

good part of the new freeway lies along Stevens Creek. This aerial photo oking north toward Moffett Field was taken above the El Camino Real interange. City of Mountain View is to the left.

The Stevens Creek Freeway (Route 85) is a new and interesting highway through the mushrooming Santa Clara Valley. It starts at the Bayshore Freeway near Moffett Field and ends at Route 280, bypassing the downtown sections of Mountain View, Sunnyvale and Cupertino, yet serving them by five strategically located interchanges.

It also takes traffic bound for Santa Cruz around central San Jose and on to Route 17 southwest of the city.

The new freeway, which cost $6,500,000 and took two years to build, follows Stevens Creek through a belt of woodland and parkland being preserved and developed as part of Santa Clara County's Stevens Creek park chain.

The park chain will have hiking and riding trails and picnic areas, and together with the freeway landscaping (already budgeted) will establish a green-belt oasis across the northern end of Santa Clara County.

The existing woodland along the creek is still the home of many quail, pheasants, rabbits and squirrels, and some opossums and raccoons.

Special attention was given during freeway construction and installation of drainage facilities to preserve natural trees and shrubbery.

The Noise Listeners

BY CHARLES F. GUSTAFSON

PHOTO RIGHT—Karl S. Parsons, research engineer, checks the signal which tells his audience to "listen." PHOTO BELOW—In a natural cut, the diesel's roar echoes back from every hill.

Motorists driving the Ridge Route north of Los Angeles on a recent afternoon had a captive audience. As trucks, buses and passenger cars ground and thundered up the 3-percent grade, a group of about 40 persons seated within 10 yards of and facing the roaring expressway, intently listened to the highway sounds.

A microphone just off the highway edge fed the tape recorder spinning nearby, recording for latter comparison playback, and the "audience" punched its cards, judging the sound level each vehicle achieved in a range from "very quiet" to "very noisy."

The tests continued through the afternoon on both sides of Route 99, with frequent breaks intended to keep collective judgments fresh and uniform. It is hoped analysis of the results will determine average tolerance, both psychological and physical, to a variety of typical community noises, of which traffic noise is only one.

The noise judgment tests were conducted by Bolt, Beranek & Newman, Inc., acoustical research engineers of Van Nuys, as part of a study for the Federal Aviation Agency on community noises. The total survey, which included similar "listening" sessions the same week at both the Van Nuys and International Airports in Los Angeles, is intended to evaluate the average person's sensitivity to noises from sources such as trucks, automobiles, and aircraft.

The 40 "subjects" included college students and adults from the vicinity of International Airport, preconditioned to flyover sound levels. Prior to the formal tests, the hearing of each subject had been calibrated in an echoless chamber at predetermined sound levels. Variations in individual hearing ability are compensated for in the final computer analysis of the punch cards.

The engineer in charge of the tests was K. S. Pearsons, M.I.T. electrical engineering graduate and a specialist in psycho-acoustic research. He was assisted by other engineers on the research firm's staff.

Newton H. Templin

1904–1966

Newton H. Templin, road commissioner for the County of Los Angeles, died suddenly of a heart attack on May 8 in Pasadena.

He had administered the extensive Los Angeles County highway program since 1959.

It has been said of Templin that perhaps no man in the history of the road department has contributed as much to its growth and development. He was a strong advocate of close cooperation among city, county and state governments in the planning and construction of highways. At the time of his death he was the member of several national and regional committees on highway and land utilization problems.

He was a member of three committees of the National Association of County Engineers, including chairmanship of the Committee of Finance, past president of the southern California chapter of the American Public Works Association, and vice president of the County Engineers Association of California.

He was also chairman of the Joint City-State-County Cooperative Committee of the Metropolitan Transportation Engineering Board and chairman of the Highway Advisory Committee of the County Supervisors Association of California.

His other affiliations and memberships included the Committee on Los Angeles County Beautification, California for Modern Highways, Citizens Economy and Efficiency Committee, Institute of Transportation and Traffic Engineering Advisory Committee, Los Angeles Regional Transportation Study and Los Angeles County Watershed Commission.

Mr. Templin was a native of Los Angeles and a graduate of the California Institute of Technology. He joined the Los Angeles County Road Department shortly after his graduation in 1925.

During his career with the county he served as executive head of the department's three largest activities—highway design and construction, highway maintenance, and bridges.

He was appointed successively to the positions of assistant chief deputy road commissioner and chief deputy road commissioner, culminating in his appointment as road commissioner by the board of supervisors on July 1, 1959.

Mr. Templin is survived by his wife, Laura Judith; a son, Charles, of Alhambra; a daughter, Mrs. R. O. M. Phillips, of Woodland Hills; and four grandchildren.

Bylines

STEVENS CREEK FREEWAY. Robert N. Keller, 1, is a native of Burlingame and a graduate of San Jose State College who joined the Division in 1950. Now a highway engineering associate in the San Francisco office, he recently was cited for outstanding design work in the field.

MAD RIVER-BLUE LAKE FREEWAY. Ernest J. Reed, Jr., 2, was born in Arcata and attended Humboldt State College. Now a highway engineering associate in Eureka, Reed joined the Division of Highways in 1946.

AUTOMATIC LANE CONTROL. Vernon H. Waight, 3, is a native of Sacramento and a graduate of the University of California at Berkeley. He joined the division as a part-time employee in 1936 while still a student. Now a senior electrical engineer with the San Francisco office, Waight has served on national committees of the Illuminating Engineering Society and Institute of Traffic Engineers.

GRAND OAKS STUDY. Stuart L Hill, 4, was born in Hollywood and graduated from U.C.L.A., where he also spent two years in graduate study. He is assigned to the Headquarters Right of Way Research and Development Section of the State Division of Highways in Sacramento and is responsible for statewide research on the impact of freeways upon local communities.

Christos Brianas, 9, was born in Greece and came to New England at an early age. He is a graduate of the University of Miami (Florida) and attended University of California graduate school at Berkeley for two years. Prior to joining the division as an economic analyst in 1965, he was a market analyst with a private electric company in Cleveland, Ohio.

CRESTLINE INTERCHANGE. Tek Tanaka, 5, is assistant to the senior highway engineers in the construction department of the State Division of Highways office in San Bernardino. He attended Riverside City College and California State Polytechnic College. He has been with the division for 10 years.

UKIAH TO BOONVILLE. Brian T. Colwell, 6, was born in Sandpoint, Idaho, and attended North Idaho Junior College and the University of Wyoming. He joined the California Division of Highways in 1954 and has been resident engineer in charge of major highway projects in northern California.

LOOK, MA, NO TRAFFIC LIGHTS! and THE NOISE LISTENERS. Charles F. Gustafson, 7, assistant information officer in the division's Los Angeles office, is a native Iowan and graduate of Northwestern University. Before joining the state in 1965, he spent many years as a product and marketing analyst for private corporations.

FREEWAYS ON CANVAS. Eleanor Wood, 8, assistant information officer with the Division in Los Angeles, was born in Cambridge, Massachusetts, and received her B.A. from Syracuse University. She has done both newspaper and magazine writing and before joining the state in 1965 was working on assignment for 63 national business and technical publications.

WALKER CANYON. Earl Rogers, 10, was born in Los Angeles and graduated from U.C.L.A. He was recently promoted to senior highway engineer with the division's Computer Systems Unit in Sacramento. At the time he authored the Walker Pass article he was project design engineer in the San Diego district office.

Authors of MERCED CITY-COUNTY JOB and DERSCH ROAD are city and county officials of the State of California. Verne L. Davis is Road Commissioner of Merced County, Howard M. Carter is Director of Public Works for the City of Merced. Donald D. Chamberlin is Director of Public Works for Shasta County.

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VOLUME 45 SEPTEMBER-OCTOBER 1966 NOS. 9-10

AN ENGINEER LOOKS AT AESTHETICS 2
By Louis G. Kroeck

FROM THE DESK OF R. J. DATEL 10
By Robert J. Datel

WHAT'S UP—IN THE AIR? 12
By Eric P. Gront

LONG BEACH 18

FIRST NIGHT PAVING JOB 26
By Charles F. Gustafson

SIMI VALLEY FREEWAY 30
By Charles F. Gustafson

JOHNNY LUPINESEED 36
By Morcia J. Mickelsen

BRIDGE DESIGN AWARDS 38

HIGHWAY COMMISSIONER JAMES A. GUTHRIE DIES 40

WELL DONE 42

NEW USE OF SPACE 43
By Howard Smith

BYLINES 44

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"An outstanding network of state highways is essential to the future growth of California's economy"
—*Governor Edmund G. Brown*

Front cover:
Car and boat on trailer on ramp, with city skyline in distance, symbolizes the mixture of recreation and urban development in the city of Long Beach. See story on page 18. Photo by Sam Smith, District 7 Headquarters, Los Angeles.

Back cover:
Scene is view from Highway 395, Conway Summit, just north of Mono Lake, looking toward the High Sierra, through magnificent groves of aspens in this vicinity. Photo by John Meyerpeter, Headquarters Photo Lab.

an engineer looks at aesthetics

Louis G. Kroeck

Fancy phrases will not get the job done! "Yield to the environmental needs of our community soul," or "Understanding the psychology of the fashions of our great society," may be fine for Sunday afternoon reading, but they are of little help to an engineer who works with specifics. Although deeply concerned about the "soul" of a community, he can find little in the way of constructive advice in these phrases that he can apply directly to his projects. He asks, "What specifically can I do to enhance the appearance of my project?"

Engineers have long recognized that public acceptance is the key to success of the highway program. They are also well aware of the popular movement for more beautiful highways. It is difficult, however, for an engineer to rapidly change his approach after so many years of trying to stretch the limited funds in order to keep ahead of the expanding traffic problem. The engineer's approach is a realistic one based on the knowledge of cost and traffic needs. There was a time when the major job was to pave our unimproved road network as rapidly as possible. This phase of our work—"getting out of the mud"—is well behind us. Our newer roads are sophisticated in all respects except perhaps for their appearance. Now that the foundations of a basic highway transportation network have been laid, the public is beginning to expect some amenities from the gas tax dollar. An all-weather surface and adequate traffic interchanges are no longer amenities but something the public expects with each highway project. The engineer is left to grope for some reasonable balance between function, cost, and aesthetics.

Today the engineer is in an enviable position. He now has the skill and resources to shape a new environment. He must also accept the responsibility of recognizing the qualities that make one environment different from another.

There is no doubt thar superb works have been created by engineers. Engineers have also made their mistakes. One of the problems is that engineers have sometimes taken a narrower view of the work than the highway user or viewer.

The highway engineer's primary concern is moving traffic in as safe and economical way as possible. Few people in the past have questioned this noble endeavor. The vast majority in past years have envisioned the highway engineer as a hero in getting traffic onto pavement and across rivers.

Times are changing and engineers must keep up with this change. Hopefully, there will be some additions to the curricula of our engineering schools. Schools of architecture have long required their students to be well versed in structural design as well as aesthetics. Engineering education could well benefit from a focus in the field of balance, form, and texture.

Our engineering schools, being sensirive to the changing needs, can and will meet the challenge. Any change in the academic program, however, will be slow in producing results, due to the inherent time lag of education. An immediate educational program is therefore necessary for the engineers already in the field. The Division of Highways is meeting its share of the problem head-on. A training program is well underway at the time of this writing. This program is only the beginning. Each highway district hopefully will carry on a training program on a continuing basis.

Good highway design includes rounded cuts, attractive signs, and open vistas to add interest for the traveler.

Motivation is not the primary problem. Engineers in Planning, Design, and Construction have always been attentive to the appearance of their projects. However, the majority of highway engineers and technicians need to be told specifically what part they can plan in this beautification movement. The immediate program dealing with specific details reaps quick results in public acceptance. A long-range educational program, however, will be required in building of another dimension to add to function and economy—aesthetics.

District 10 has been quick to recognize the problem and the needs. The first action by the district engineer, J. G. Meyer, was to appoint a "scenic highway committee." The committee was composed of representatives at the senior level from Maintenance, Construction, Traffic, Right of Way, and the Design Departments. The committee was given complete freedom to formulate its own method of operation, responsibilities, and limitations.

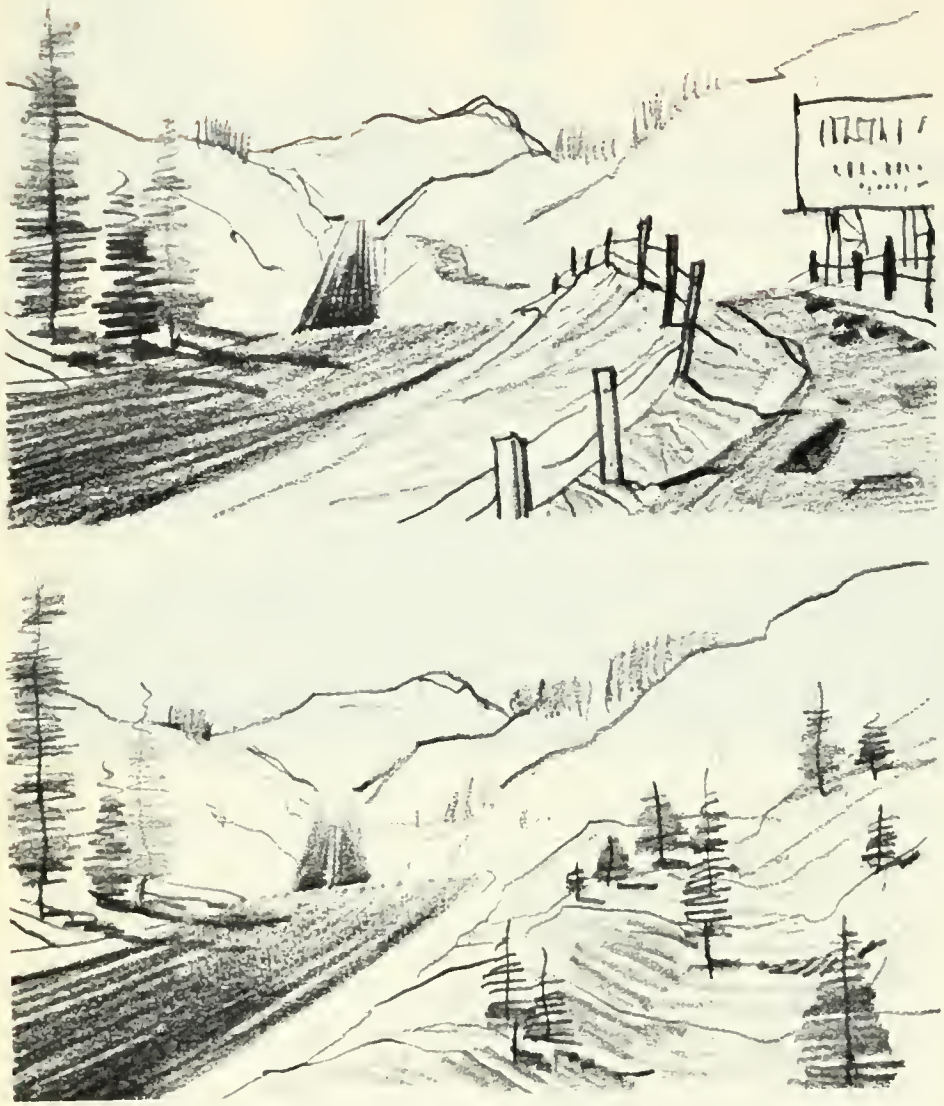
The following general guidelines were formulated after the first meeting of the committee:

1. The committee's activities should not be limited to the scenic highway system but should encompass all highways in the district.
2. On the district level the committee should concern itself initially with details both in design and construction since it appeared that the sum of the details will show results in the shortest possible time.
3. The second phase of our studies should encompass the long-range planning aspects of route selection.
4. The first task was to evaluate our present highways both by observation and by study of available material.
5. Prepare and execute some kind of educational program within the district based on our evaluation of existing highways.
6. Prepare some type of standard and guidelines for all departments.

As a method of operation to evaluate our existing highways, the committee has made a field trip once a month to study, discuss, and photograph both good and poor details. The collection

"WHAT SPECIFICALLY CAN I DO TO ENHANCE THE APPEARANCE OF MY PROJECT?"

ILLUSTRATIONS BY LOU BAKER



On realignment, old paving, unsightly structures, and unnecessary piles of dirt should be cleared away, the ground smoothed, and return of natural growth of trees and shrubs encouraged.

of color slides resulting from these trips is used by the committee for further office study. The slides will have additional use in our proposed educational program within the district. The mere existence of the committee has helped to stimulate others in being more critical of their past work. This has been evident in every department.

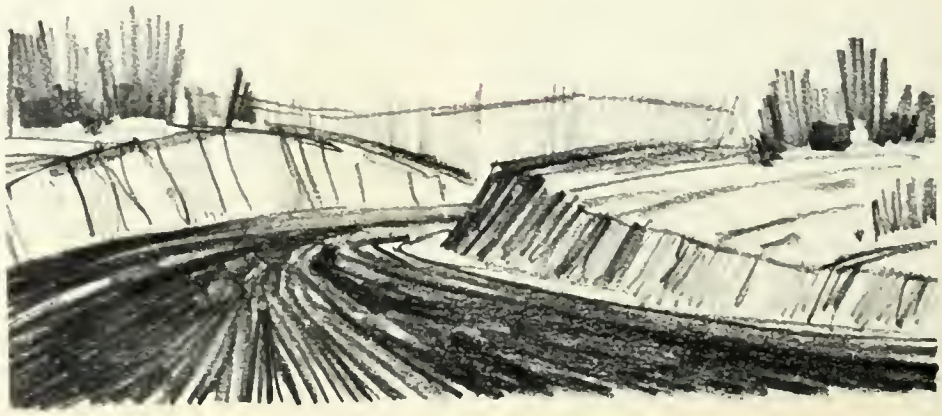
The committee has been in existence for only two years, but the results are already evident. Its first efforts were directed toward projects under construction. Almost everyone was eager to cooperate. Although the changes made during construction on the various projects were within the project fiscal allotment, the end product in some cases was beyond expectation and served to point out that in this field of aesthetics much can be done at small cost.

Let's step back and take a quick look at a few of the details District 10 has considered as a starting point for a long-range program in our attempt to improve our highways from an aesthetic standpoint:

Fit the Environment

In a rural area this means that, regardless of the height of cuts or fills, the natural ground should appear to begin at the edge of the shoulder, not at the right-of-way line. If the highway is built on flat land, the slopes should be flat. Ditches should be nonexistent or at least with very flat slopes. In rolling country the slopes should roll and warp. The cuts and fills should appear as part of the country, not as part of the roadway. In rugged steep terrain the cuts should be rugged and steep.

This philosophy is not without its problems and its conflicts. In a forest area should the cuts be held steep to save trees, or should additional trees be taken to flatten and round the slope?



Instead of sharp cuts, slopes should be rounded to eliminate tunnel effect and to fit slopes into natural contours.

In general, the slopes should be flattened and rounded. The slopes are permanent. The trees will grow anew. The slope, however, can be warped to save a particularly fine specimen or group of trees. This philosophy must vary, of course, with the location, giving full consideration to the type and age of the trees. The U.S. Forest Service has been very helpful in this respect. They are interested in the long-range planning program for the forest areas. Certainly the Forest Service should be brought into the picture in the early stages of a project.

Interception ditches at the top of cut should be held to an absolute minimum since they interrupt the continuity. If a ditch must be lined with concrete, native soil should be broomed in while it is still wet, or asphaltic emulsion should be sprayed on for a camouflage. There is little more disrupting to the scene than a white stripe through the green belt adjacent to a highway.

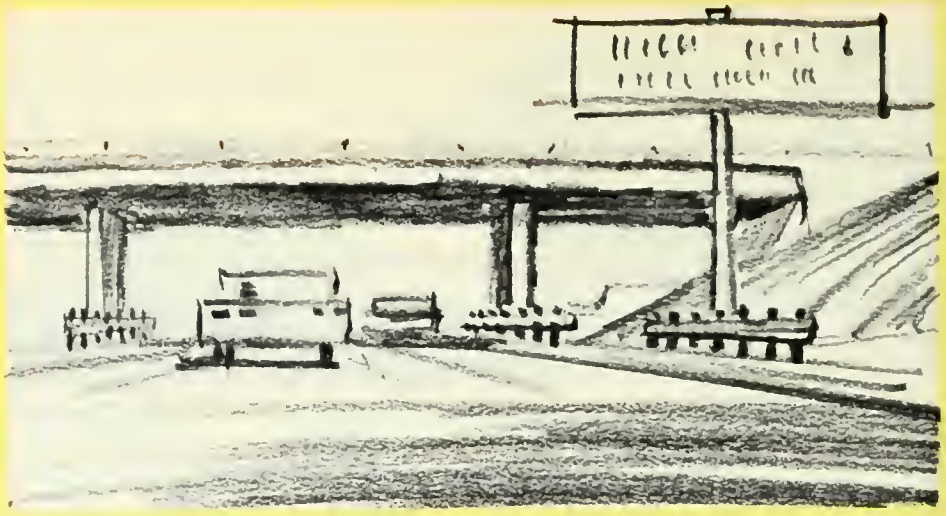
Remove Old Pavements

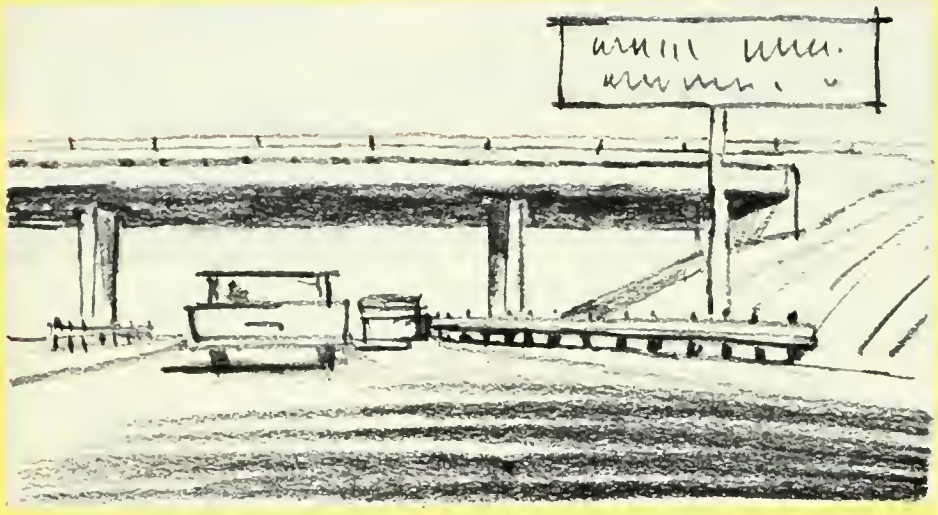
There are many places in this state where not only does the old pavement show, but also the pavement before that. Even the poor pavements of many years ago leave an almost permanent scar on the countryside. Remove the old pavement, remove the old culverts, fences, and signs. Fill the old cuts and remove the old fills. Then seed the entire area. This has been done in District 10, and the cost has been surprisingly small.

End-post extensions on bridge railings can be eliminated and railings faired into the ground.

Horizontal and Vertical Curves

Lengthen them! Seldom do short vertical or horizontal curves fit into the landscape. In rolling country the vertical curves should be longer than the tangents between them. This will produce lines that flow rather than jerk. If a curve radius must be short, be sure to lengthen the superelevation transition. This tends to ease the visual abruptness of the curve and prevents the unpleasant, warped appearance so often seen on multilane highways.





Rather than several short sections of guard rail which created jagged, interrupted effect visually, use a single, continuous guard rail which costs little more and gives a much smoother effect.

Continuity

The highway, as a continuous, almost never-ending strip, must be held together by its continuity. The higher the speed of travel, the more important this becomes. Changes along the highway and changes in the highway itself should not be abrupt. Not only should visual abruptness be eliminated from the highway alignment, but the visual abruptness should be held to a minimum in all features of a highway. The importance of continuity reaches into every facet of highway design and construction: A smooth-flowing fence rather than one that follows every minor high or low spot on the ground. A right-of-way line that either curves or is on short tangents with small angle points. Edges of pavement that don't jump in and out.

How often do we see multiple short sections of guardrail where one long section could be placed at only a small additional cost. A long piece of guardrail can add continuity. A short piece reduces continuity. Remember, at highway speeds, all lengths become compressed.

Consideration should be given to coordination of the bridge rail and the approach rail. If one type of rail could do for both, the continuity of the facility would be greatly improved. Pavement types is another area where continuity is important. A white bridge deck on a black pavement is an abrupt break in the continuity.

Special Features

Be ever aware of those special points of interest—an exceptional view, an interesting formation, a group of trees or rocks to break the monotony, an interesting historic feature. Take advantage of each of these. Remember, a view of a city's industrial area, to some people, is as interesting as a high Sierra Nevada view.

Cut Benches

Only where absolutely necessary! A widened section at grade will usually serve the purpose. It not only looks better but adds width to the roadway for parking or maneuvering.

Contour Grading of Interchanges

Slopes that warp and flow are far more pleasing to the eye than the precise, straight, geometric slope so often seen on our highways. It is true that a warped slope is more difficult to stake and construct. The results, however, are worth the effort. A curved, fluid surface will fit any environment to a far greater degree than the conventional 2:1.

Drainage Structures

There should be little visual evidence of drainage structures. Bury all downdrains. Substitute culvert end sections for headwalls. Use only grate inlets in the median or where visible. Where flat slopes are used, extend the culvert to intercept the slope line. Don't warp the slope to have a few feet of pipe. The use of flared end sections is far superior to headwalls where slopes are flat. They fit the slope better; they do less damage if hit by a car; they are superior hydraulically; they are easier to maintain; and they are usually more economical.

Dramatic rock formations should be left in place to add interest to the route.

Rock Outcroppings

If a rock outcropping appears on a slope, work around it. It will probably look much more natural to leave it in place than it will to remove it. This is especially true in an area where rock outcroppings already appear in nature.

Daylight Cuts

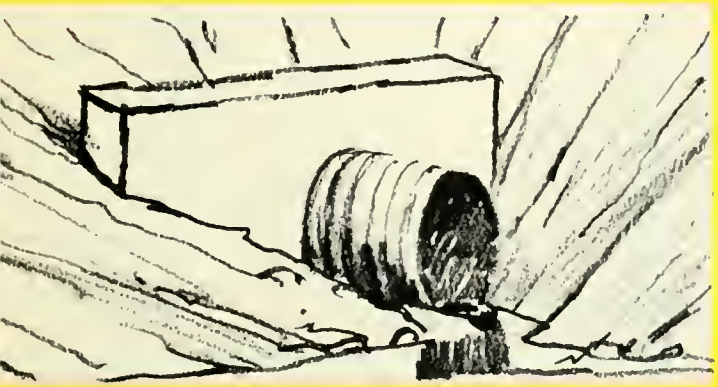
From an aesthetic standpoint, a through cut should be avoided wherever possible. A through cut is not only unpleasant from a visual standpoint, but it leaves much to be desired from an emotional standpoint. While the claustrophobic reaction is usually mild, nevertheless, it is an undesirable play on the emotions of many people. Whenever a cut can be widened, the slopes flattened, or one side daylighted, this undesirable emotional reaction can be eliminated.

Highway Hardware

In many cases, the highway engineer is his own worst enemy! There is little beauty in a multiplicity of signs, signals, lighting standards, and guard markers. We should do what we can to subdue or eliminate these facilities. Keep in mind, the fewer the signs, the greater the impact of the remaining signs. In a forest area, a natural wood guide marker may be the answer. The wood post will hold the reflector just as well as a steel post. Maybe the elimination of the white paddle is the answer. The paddle is of little value in the daylight, and the reflector is all that can be seen at night. Also, in a forest or in rural areas unpainted wood posts should be used. They do just as good a job of holding a sign as a painted one. Not only are they less obtrusive, but they are less expensive. Other hardware should be painted a soft color to blend with the background. The backs of all signs should be painted. This renders them less distracting, thereby adding to the safety of the highway. Whenever possible, place signs back to back on the same posts.

Right-of-Way Width

Experience has shown that seldom are our highways situated on an adequate width of right-of-way. What appears to be ample during the design stage seems always too tight after construction. Consideration should always



Structures to protect culvert openings are usually not necessary. Piled rocks will do as well in most cases, and are much less noticeable.

Where terrain permits, a very wide median is much more satisfactory aesthetically. The median can be left virtually undisturbed in its natural state, cuts and fills can be kept on a smaller scale, and both roadbeds fitted into the contours more easily.

be given to future planting—especially to screen planting where necessary. A little additional right-of-way width is often desirable to include a group of trees or a rock outcropping. The area between the top of cut or toe of slope should act as a buffer zone. Often a little extra right-of-way will preserve a view. Always assume that the adjoining property owner will build right to the right-of-way line.

Final Cleanup

This is one of the most important operations on a project, but unfortunately it is often overlooked. This is the frosting on the cake. All areas should be shaped and all debris removed. This includes the removal of all construction stakes.

These are only a few of the details that are being given close examination. They do, however, illustrate what we in District 10 are looking for as a stopgap program. This is only one facet of the total program planned for District 10. It is, however, the portion of the program that will show results in the shortest possible time. It is also the portion of the program most easily understood and most quickly accepted by all concerned.

Future Program

As this initial program takes shape, the district scenic highway committee will be able to devote time and effort to the aesthetics of highway planning. In this area, the guidelines are necessarily general. They must be flexible enough to cover all highway planning situations—urban, rural, mountain, and valley. Opinions are diverse on the application of aesthetic guidelines in relation to the planning of specific projects.

More can be accomplished toward the pleasing appearance of a highway in the relative freedom of the early planning stages than in the design and construction stages which are controlled by what has gone before. Consideration of all the features which will contribute to the aesthetics of a highway, such as wide medians and adequate right-of-way for slope clearances, contour grading, planting, and drainage facilities, may rule out certain locations at the beginning.

Our planning has been attuned to the desires of the local communities. This awareness comes through continuing liaison between Highway Planning personnel and community citizens. Sensitivity to local needs is necessary to arrive at a balance between costs, traffic benefits, and community values. In the final analysis these factors are weighed by the California Highway Commission in each specific instance to arrive at a highway location that provides the optimum combination.

Our planning of routes through a community includes a study of the pat-

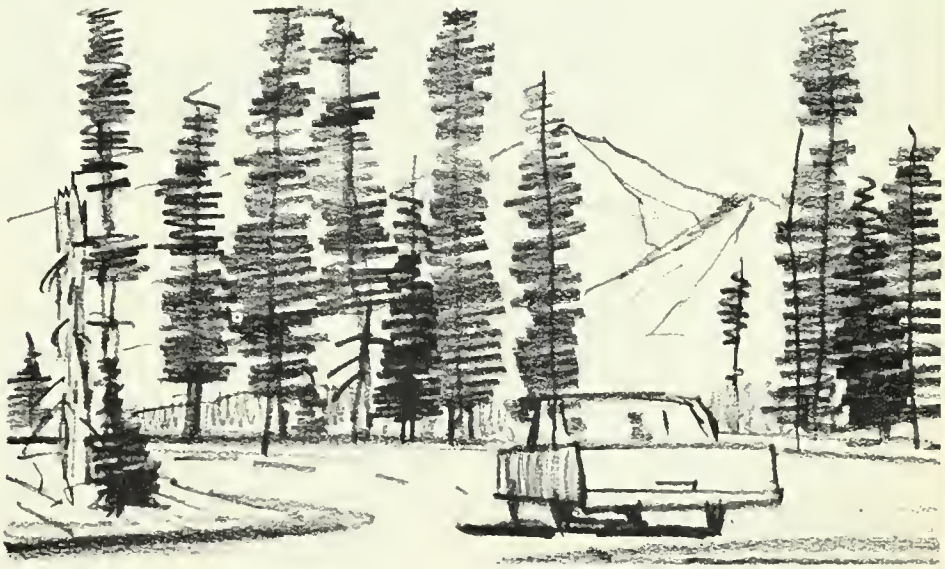
tern of land ownerships to minimize the creation of small odd-shaped parcels that are difficult to use and often detract from the appearance of the surroundings. Among other items that are considered are the boundaries of school districts, locations of public facilities, and zoning. The general plan of the community and outlying unincorporated areas is also an essential source of information in the planning process. Thus, a thorough knowledge is developed of the geography and general makeup of the community so that the highway may be integrated with the local scene rather than forced through it.

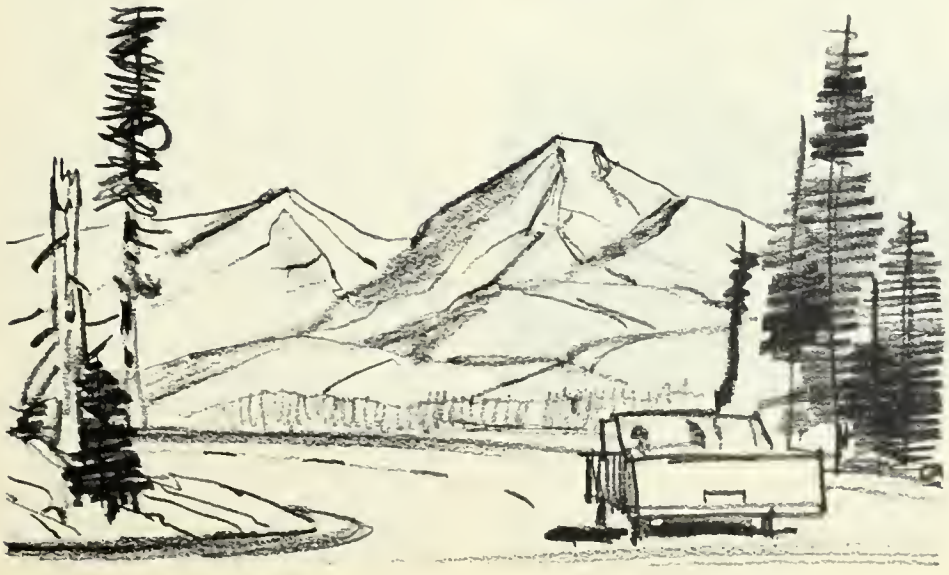
The local community will generally direct attention to sites of historic value early in the planning stage. What may appear to be a pile of junk or even vacant land to a stranger may be a site of some historic event or a last link to a past era dear to the heart of the local community. Although many of us admire the shine and glitter of newness, others prefer the patina of time. This may seem somewhat removed from aesthetics; however, the reactions on one's emotions are just as real, just as strong, as the emotions that come into play when viewing a beautiful scene. In this instance, the emotions are experienced by the community rather than the highway user.

In rural areas, every effort is made to achieve compatibility with the area through which the highway travels. This is of prime importance to both the highway user and the highway viewer. In rolling or mountainous areas, a curving alignment can be used effectively to conserve existing features of the terrain. As the alignment for a new highway is being developed, consideration is given to the view from the roadway itself and possible roadside vista points and rest areas for the enjoyment of the traveling public.

Aesthetic excellence has its birth in the highway planning stage and is often inherent in the highway location. In the following stages of design and construction, close attention to aesthetic details will ensure a completed product in which all contributors can take pride.

District 10 has produced some notable examples of aesthetically pleasing highways in the past. The district scenic highway committee's efforts will contribute to even better results in the future as it reviews and gives advice on each highway project from the start of planning through the completion of construction.





Although it may mean some loss of natural vegetation, the practice of "daylighting" to give travelers an unrestricted view of natural grandeur is highly desirable for adding dramatic values to the highway.

From the desk of R. J. Datel

(Editor's note: This credo on highway aesthetics written by the district engineer of District 5, San Luis Obispo, to his employees in that district's house organ, The ReVue, *is a perfect supplement to the Louis Kroeck article which precedes it. We are fortunate to have it so opportunely to reprint here.)*

We are aware of the natural beauty that abounds in the central coast region of California—of the ever changing coastline that varies from rugged mountains to rolling hills to broad sandy beaches—of the fertile Salinas Valley ringed by mountains carpeted in colors ranging from golden brown in late summer to brilliant green in early spring—of the large unspoiled reaches of San Luis Obispo County and the smaller picturesque ranches of the Santa Ynez Valley—of the charm of the City of Santa Barbara, home of the Queen of the Missions—of the colorful springtime fields of golden poppy and blue lupine of the Nipomo Mesa and of other areas in our district —of the sturdy oaks and stately eucalyptuses that dot our landscape in any direction we look—of the pines, the cypresses, the acacias, *Ceanothus* species, the oaks and the dozens of other inspiring trees and shrubs of the Monterey Peninsula. Yes, we are aware of this natural beauty and of how it enriches our lives, and we are aware of our responsibility—as public employees and as citizens of our state—to do our best at conserving this rich heritage.

We have other responsibilities as employees of the Division of Highways—we must be dedicated to providing a safe, efficient and economical highway transportation system in California. These three characteristics —safety, efficiency and economy—are not incompatible with beauty. A safe highway—one with wide medians, good sight distance, long-radius curves, smooth pavement, wide shoulders—can be a beautiful highway. An efficient highway—one with access control, a freeway—can be a beautiful highway. An economical highway—one stressing the use of widened cut sections, natural plantings and minimum signing—can be a beautiful highway.

It is the proper mixture of the four ingredients—safety, efficiency, economy and beauty—for each particular project that requires the maximum in skill, knowledge and experience. In District 5 we have been aware of this for some time and we have some good examples of aesthetic highways to show for our efforts. A few of these include Highway 101 through San Luis Obispo, north of Buellton, and through Montecito; Highway 1 between Cayucos and Cambria and the Carmel Hill interchange; and Highway 154, the new San Marcos Pass project which opens up some magnificent scenery.

Our critics say that we are interested only in speed and that we always build our highways as short and therefore as straight as possible. I say that user benefits are one of several factors we consider but that we try to build our highways to fit as naturally into the landscape as possible considering our design standards. If a straight line is the most natural, we will build straight lines. If curves are more natural, we will build long-radius curves.

Our critics say that we destroy natural beauty without feeling because we are insensitive to beauty. I say that we are responsible for removing trees, shrubs and natural growth and therefore do "destroy" natural beauty but *not* because we are insensitive to it. Wherever possible we replace the trees and shrubs removed with new ones. I believe we are just as sensitive as anyone about beauty because we also are people. I feel we are *more* aware of the natural assets of California than the average person because we *are* employees of the Division of Highways. No other organization in California, to my knowledge, public or private, plants as many trees, shrubs and ground cover plants each year or has as extensive a landscape maintenance program as we have. One example is our recent planting of 17,000 seedling Monterey pines along Highway 1 through Cambria to replace several hundred mature trees taken out during construction.

Our critics say that we use "scare tactics" in promoting freeways—that we quote statistics on lives lost and injuries sustained in order to scare people into accepting freeways. I say that freeways have proven to be the safest type of highway facility for vehicular traffic and that we can predict with reasonable accuracy how many lives will be saved and how many injuries prevented by building a freeway. I believe strongly that the one factor of the four previously mentioned that should not be compromised is safety. We can grow a Monterey pine, a live oak, a redwood tree, a California poppy—we cannot replace a life. As highway engineers we must in my opinion assign greater importance—where a compromise is necessary—to a person than to a tree.

Our critics say that we should build scenic highways, not freeways. I say that access control—or freeway de-

US 101 through San Luis Obispo, the headquarters of District 5, is one of the most beautifully landscaped sections of freeway in the state.

Right: Scenic view of Carmel Bay and highlands behind Carmel as seen from edge of Highway 1. Informal plantings of Monterey Pine and Cypress were placed by Division of Highways in early 1930's.

State Route 1 along edge of Santa Lucia Mountains in Monterey County, better known as Big Sur Country, is first route to be taken into the state scenic highway system.

sign—is the best friend the scenic highway has. To fulfill the intent of the scenic highway concept what happens outside the right-of-way is equally or more important than what we do inside the right-of-way. Access control provides everyone involved in scenic design with a valuable tool.

Our critics say that we have too much authority and therefore fail to do what the "public" really wants. I say that we must be, and I think that we are, willing to sit down and discuss our designs with anyone and everyone. We must have public acceptance for the highway program. We have a great deal of experience working with advisory groups, and we must always be willing to work with them. We must also realize that *we* are responsible for the design of state highways and be willing to make hard decisions when there is an honest difference of opinion between our advisors and us. We must listen with openness to the advice and council of others and, equally important, accept our responsibility with courage and conviction. Our critics, our detractors or our advisors need not defend our highway designs—it is Mr. Womack and you and I who must defend them. Let's not be in the position of looking at a mistake in design after it's built into a job and say, "We didn't want to do it this way, but the advisory committee wanted it." Rather, let us say under such circumstances, "We are responsible, we will correct it and we will learn by this mistake."

Our critics say that we can do a better job of aesthetic design—and I say we can do a better job. On this point I agree. For example, we can still improve upon our contour grading at interchanges by better handling of open drainage ditches or exposed drainage pipes and junction boxes. We can reduce the number of "things" we stick in the ground and entirely eliminate the orange survey markers that stick out like a sore thumb on scenic highways. We can insist that bridges are designed to eliminate the abutments or piers adjacent to the shoulders for both beauty and safety. We can design wider medians, split-level roadways and wider rights-of-way when appropriate. We can widen cuts and eliminate through cuts. We can strive to get better-than-minimum design standards especially for sight distance. We have done well in District 5—we can do better—and I say we will do better.

The State Highway Engineer sitting in his Sacramento office saying that we will do better will not make it so—but it is an important beginning. The district engineer standing here before you saying that we will do better will not make it so—but it is an essential ingredient. The aesthetic training course you are about to participate in will not make it so—but it is a step in the right direction.

How then can we do a better job? It will be done by you—by the same people who have designed, constructed and maintained the greatest highway system known to man. You will sharpen your technical tools, expand your creative ability, and I hope generate a great deal of enthusiasm for meeting the challenge of more sophisticated highway engineering—highway engineering that provides the best possible blend of safety, efficiency, economy and beauty in every job you turn out.

What's Up - in the Air

By Eric P. Grant

PINTO BEAN leaf damage by smog is visibly demonstrated in these pictures from University of California Air Pollution Research Center, Riverside. Plants on left and right have been attacked by sulfur dioxide and ozone. Center leaf is unaffected. Smog is responsible for $132 million in crop damage and loss every year in California.

Man has finally come to recognize that air is a valuable natural resource.

Either we conserve it or, as one eminent UCLA meteorologist warns, "Civilization as we know it will disappear within 100 years." The amount of air available to sustain life on earth is comparable to one coat of varnish on a child's world globe.

Today 70 percent of all Americans live on less than 10 percent of the land. Almost everything we do, from cooking food to driving an automobile, dirties the air.

Or to put it in more personal terms, not one of us would think of dumping his household trash in the middle of the living room. Yet this is exactly what we are doing to our atmosphere every day when we dump the wastes from home, industry, and transportation into the skies. Then we turn around and breathe this aerial "garbage."

We should really not be surprised that we have polluted our air in California. It would be surprising if we had not. The state grew in the 1930s and 1940s from agricultural economy to a great industrial complex centered in five or six sprawling metropolitan areas.

Take the automobile, for instance. We have 11 million in the state using between 18 and 20 million gallons of gasoline each day. The internal combustion engine which powers our vehicles is relatively inefficient. We lose into the air 10 percent of the total fuel we buy, or nearly 2 million gallons a day.

The irony of the loss is not only its smog potential, but its cost. The loss costs California car owners $666,000 every day of the year. To that must be added the cost of the damage done to humans and crops—a staggering figure.

Getting rid of auto-created pollution is an expensive proposition, but actual savings can be shown when they are related to the cost of installing control systems on motor vehicles.

In California we have an ideal climate in most places—abundant sunshine, mild breezes, moderate temperatures. These are mixed blessings.

It is California's sunshine which chemically converts the automobile exhaust materials and other pollutants of nitric oxide (NO) and unburnt hydrocarbons into organic ozonides which have the characteristic sweetish ozonelike odors of smog—but it is the nitric oxide and the resulting nitric acid which cause the insidious irritation and plant damage.*

Photo of Santa Ana-Hollywood freeways in Los Angeles, made on a clear day, shows large number of vehicles traveling freeways. State now has 11 million registered vehicles, will have 18 million by 1980. California can have more such clear days when control systems go on most cars in urban centers.

A layer of warm air, stretching over the Pacific from the Hawaiian Islands, acts as a lid, trapping the pollution-filled cooler air below. This air cannot disperse until the temperature inversion is broken or it stays at a fairly high altitude.

Let us talk for a moment about smog's effect on health.

We know, of course, about the terrible disasters of Donora, Pennsylvania, in 1948 and London, England, in 1952 and 1962 when thousands were stricken by severe smog and many actually succumbed. Fortunately, such a tragedy has never befallen California. But we know the eye irritation we feel on a smoggy day. And we know the nauseous feeling that comes over us when we drive through smog for any length of time.

The U.S. Public Health Service has confirmed the link between air pollution and increases in respiratory ailments. Emphysema, once an obscure disease, has grown to major proportions. Studies show that women between 18 and 30 living in metropolitan areas have a 400 percent greater inci-

* Smog consists of unburnt and partially burnt hydrocarbons along with nitric oxide (NO) from high-compression engines. This latter constituent is converted by sunlight and air to nitrogen dioxide (NO_2), which in turn reacts with the exhaust or other hydrocarbons forming organic nitrite compounds. These products promptly extract moisture from the air, forming smog, which consists of organic ozonides (having the characteristic ozone odor) and more nitric oxide, which starts its insidious action all over again.

Smog control has a twofold action: (1) to reduce the unburnt hydrocarbons in the air and (2) to eliminate the nitric oxides which cause the bulk of the trouble.

dence of lung cancer than those living in rural areas.

There are still other losses. California agriculture suffers approximately $132 million in crop damage every year because of smog, including destruction of crops, poorer quality, slower growth, and less production. Citrus tree experiments at Upland dramatically illustrate the differences between fruit produced in filtered air and fruit struggling for life in smoggy air.

Smog will peel paint from buildings, rot rubber and corrode metal. How much more frequently does the average housewife have to clean the house, wash linens or windows because of the filth in the air?

The chilling recital could go on and on.

Thus we can see that our polluted air presents a "clear and present danger."

California is not sitting idly by while the problem multiplies. It is the first state to permit strong local air pollution control districts with their own rules and regulations. Nine of these in 14 counties are working hard to stem industrial and domestic waste.

The state, in 1960, took over the unique job of reducing the poisons coming from our more than 11 million motor vehicles.

In 1951 Dr. A. J. Haagen-Smit, professor of biochemistry at Caltech, proved that automobile fumes, in the presence of sunlight, converted to smog. Up until that time, Angelenos had blamed everything else under the sun for the pollution plague.

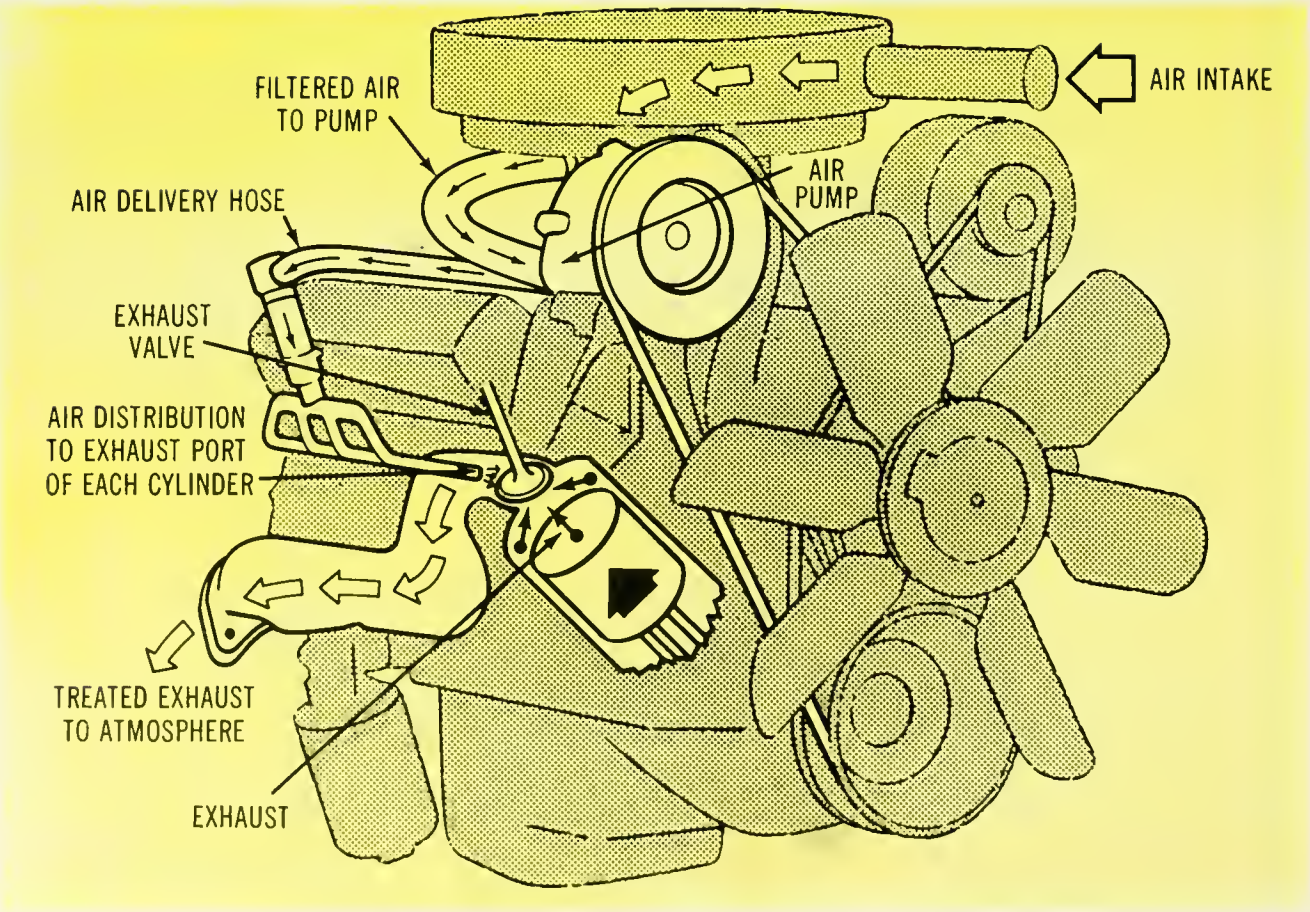
While it is true that almost every human activity contributes to air pollution, not all pollution becomes photochemical smog, except under the proper meteorological conditions, such as those enjoyed in California and other sunny climates.

The menace of auto-created smog becomes more pronounced in California as our car population continues to grow at 5 percent a year. In Los Angeles, the Air Pollution Control District acknowledges that 90 percent of that area's smog is from automobile waste. The San Francisco APCD says 56 percent of the bay area's problem originates with the motor vehicle.

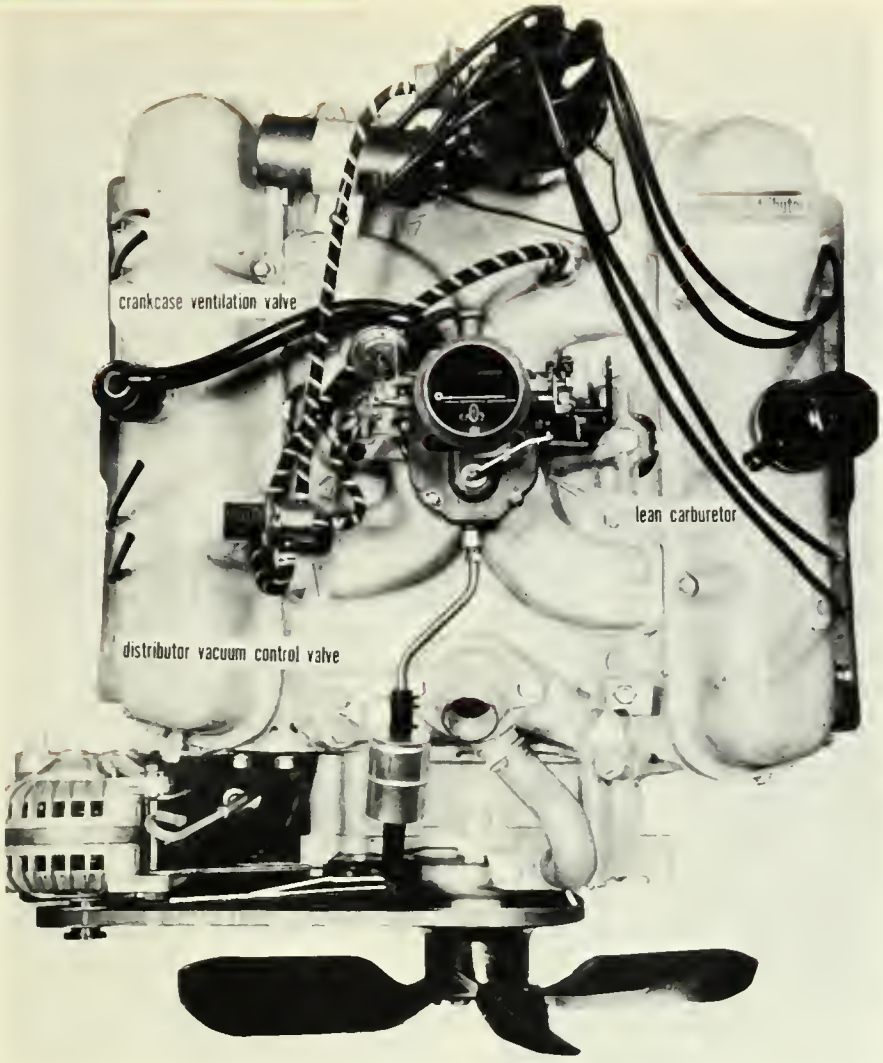
Since the automobile does not observe county boundaries, the problem is statewide. An automobile traveling from San Francisco to Los Angeles, for example, is a little smog "factory," leaving behind its trail of contamination in every county through which it passes.

The State of California became involved with auto smog in 1959 when Governor Edmund G. Brown requested the Legislature to direct standards. The lawmakers followed this action in 1960 by establishing the Motor Vehicle Pollution Control Board to test and certify control systems that would reduce emissions to Health Department standards.

Originally some people believed that if only exhaust gases were controlled this would solve the auto smog problem. Upon further investigation, engineers found that the crankcase was a repository of fumes vented to the air through a small breather tube. These fumes account for 25 percent



This cutaway schematic shows the operating principle of the General Motors air injection reactor system for exhaust emissions control. Heart of the system is a belt-driven pump that sends fresh air to a point near the exhaust valves. Fresh air promotes further oxidation of hydrocarbons and carbon monoxide emerging from the cylinder, changing them to water and carbon dioxide.



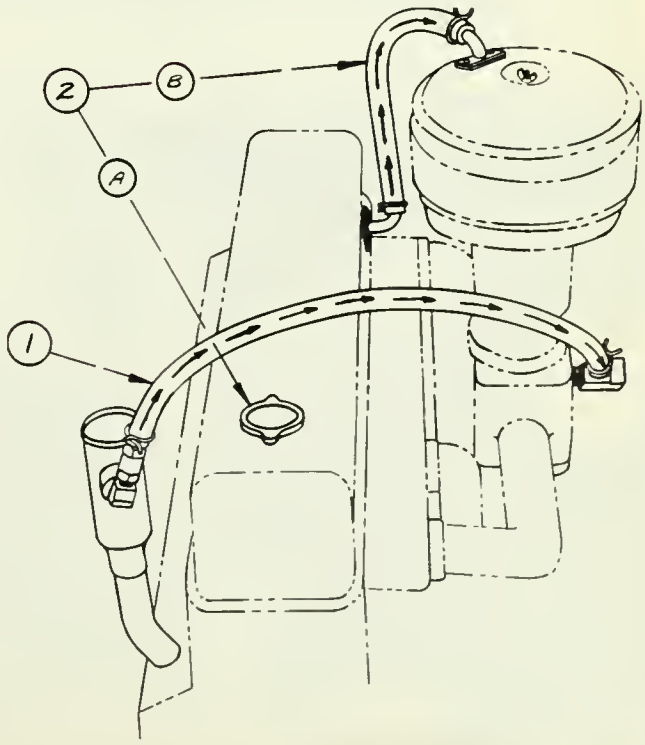
The Chrysler cleaner air package controls carbon monoxide and hydrocarbon emissions by providing optimum burning conditions in the cylinders.

of total unburned hydrocarbons (raw gasoline), while the exhaust contributes 60–65 percent and all of the carbon monoxide. A small amount also comes from fuel tank and carburetor evaporation.

The State MVPCB tackled both the crankcase and exhaust emission problems, but the former offered the greater prospect for simple solution. Automotive men had known for a long time about a breather tube from the crankcase to the air cleaner used by British car manufacturers and the U.S. Army for years to keep dirt and dust from working their way into the engine and to prevent sludge formation in the crankcase. Adaptation of this system for crankcase fume control, therefore, seemed logical.

Approved crankcase devices have been on most new California automobiles since 1961. Many are factory equipped, while thousands of other vehicles have added the devices under state requirements at time of ownership change. Today at least 6 million registered California vehicles are thus equipped, preventing the addition of 300,000 gallons of unburned gasoline from entering the atmosphere every day.

But the main problem still remains exhaust emissions. The 1966 model vehicles now being sold in California are virtually smog-free.



POSITIVE CONTROL—This "closed" positive crankcase ventilation system is approved for installation on both used cars and on new cars. Shown at right is the operation of the system during adverse conditions of high speed or extreme acceleration with a worn engine, when "blowby" tends to exceed the capacity of the original system.

If every one of Los Angeles County's 7 million residents could step into a '66 model tomorrow instead of the polluters they now drive, smog in that area would be trimmed by 70 percent.

The story of exhaust control by the state began in 1961 when the Motor Vehicle Pollution Control Board published its standards and criteria for the operation of the systems. Basically they said that hydrocarbons (raw gasoline) must be reduced to 275 parts per million of air and carbon monoxide to 1.5 percent by volume. This was a high dive into the relatively unknown field of "parts per million" chemistry.

To the everlasting credit of private initiative, dozens of America's largest and most reputable manufacturers decided to enter the race for the exhaust control market in California with the investment of millions of dollars in research and their finest engineering talent.

The problem was one of the toughest technological challenges they ever faced because of the necessity of fitting more than 500 different makes and models, operating under a variety of driving conditions, and in various stages of upkeep. Not only that, the devices had to meet other criteria of safety, heat, noise, efficient operation, longevity and, of course, cost.

The first automobile company system to be certified was the Chrysler Cleaner Air Package, approved in November 1964, and now going on all 1966 Chrysler products sold in the state.

The Chrysler CAP is an engine modification system consisting of a modified carburetor, a slightly altered distributor, and a sensing valve to control spark adjustment during deceleration. The carburetor has lean fuel jets, a modified choke calibration, and the idle set to lean adjustment. The distributor is so arranged to provide spark retard while the car is idling.

"Heart" of the system is a special vacuum-operated valve, mounted between the distributor and the carburetor. The valve senses the change in manifold vacuum when the car decelerates and "instructs" the distributor to provide the maximum spark advance at this time to provide efficient burning and thus reduce hydrocarbon and CO emissions.

The air injection reactor system, now being used by General Motors, Ford, Rambler, Kaiser Jeep, and some International Harvester station wagons, was approved by the MVPCB in July 1965, in time for installation on 1966 models. The system is the result of the greatest crash program ever undertaken by the automobile industry during peacetime.

It works on a different principle from the Chrysler CAP. It consists of a pump which sends a supply of fresh air through distribution tubes to each exhaust port in the cylinder head. There are also modifications to the carburetor and distributor. The fresh air hits the exhaust gases at their hottest point just as they come from the combustion chamber and completes combustion. In some respects, the system is like having an "afterburner" in the exhaust manifold, or, to put it another way, the system is similar to adding air to a smoldering blaze; the oxygen speeds and completes the combustion process.

Both systems do require some minor periodic maintenance, but no more than recommended by the manufacturer in the car owner's handbook to assure proper timing and carburetor adjustment.

Actually, if the car owner follows the manufacturer's recommendation, he will not only be helping to reduce deadly auto fumes but also assuring himself a longer-lasting, smoother-operating automobile.

Today, state-OK'd exhaust systems on '66 models in California are preventing the contamination of the air by 80,000 gallons of hydrocarbons and 1,200 tons of carbon monoxide every day.

The efforts of the California Motor Vehicle Pollution Control Board, and the devices that are going on vehicles, have done and will continue to do an effective job of controlling motor vehicle pollution. Other areas of state activities have also contributed greatly to the elimination of air pollution in the State of California.

There is no peer to the California highway system. Although there are those who will question its efficiency at 5 o'clock on some weekdays, it goes without saying that it is the best

State Senators Stan Pittman, Carl Christensen, and Randolph Collier, grouped in center, along with other members of special committee on vehicle pollution control, inspect emission testing equipment at Detroit automobile plant.

Assemblyman Tom Carrell, left, and State Senator Randolph Collier, chairmen of legislative transportation committees, join Governor Brown as he signs key piece of auto smog legislation. Both legislators have pushed highway and smog control measures.

means of moving masses of vehicles anywhere in the world. This efficient moving of traffic has had its beneficial effects on air pollution:

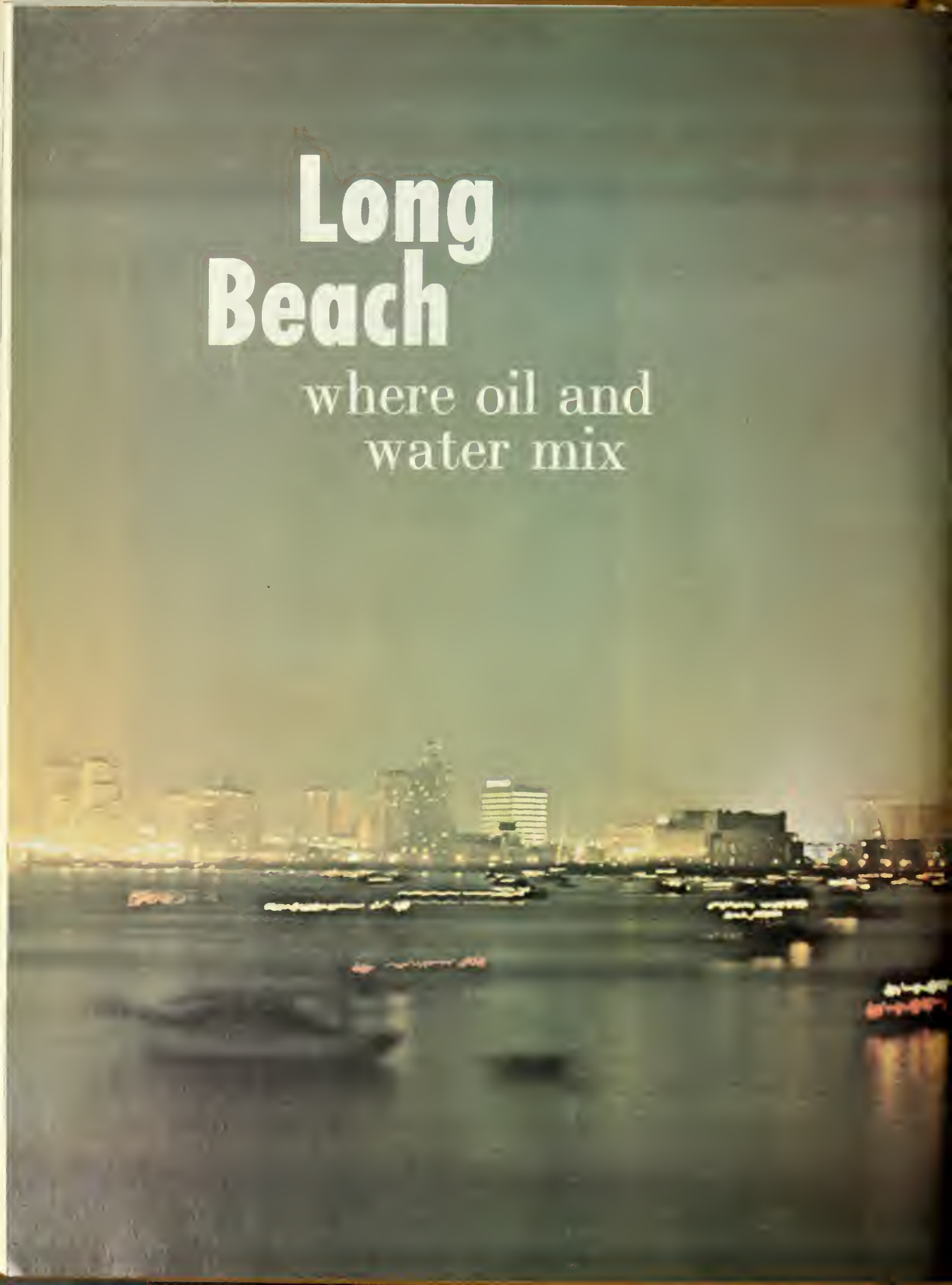
First, the basic premise of freeway construction is to move traffic rapidly at sustained speeds. We know that emissions from a motor vehicle are 20 times higher on deceleration than on cruise. It should be very evident, therefore, that with the increased traffic flow resulting from our excellent freeway system, emissions are substantially reduced.

Second, one of the premises of freeway construction in California is to provide a means for traffic to circumvent metropolitan areas. This prevents motor vehicles from becoming involved in congested metropolitan areas, where smog is most severe. Although it doesn't eliminate pollution, it spreads it out over a wider area and therefore minimizes concentrated impact on the metropolitan center.

Certainly the readers of *California Highways* are well aware of the magnificent job that has been done to provide first-class highways to handle the anticipated increase in vehicle population. State Senator Randolph Collier, Chairman of the Senate Transportation Committee, and Assemblyman Tom Carrell, Chairman of the Assembly Transportation Committee, have been strong supporters of an effective freeway system. They have not, however, neglected to recognize the importance of controlling the motor vehicle. Under their able leadership, key legislation supporting and augmenting the vehicle emission device control program has been passed by the California Legislature. Senator Collier's Senate Bill 317 was the strongest legislation and most effective direction of legislative interest in this program ever passed in the United States.

The strong recognition of the health effects of air pollution and the achievement of control expressed in SB 317 probably, more than any other action by the State of California, awakened the federal government to the necessity for controlling emissions from motor vehicles.

The cooperative effort developed under the administration of Governor Brown, the Legislature, the Motor Vehicle Pollution Control Board, and American industry has resulted in a dynamic program on many fronts to protect an important natural resource, air. Although our problem will not be solved in a year or two, we know that air pollution as it existed yesterday and as it exists today will not be present tomorrow.


Long
Beach
where oil and
water mix

OIL AND WATER are said not to mix, but in the City of Long Beach they mix very well.

Here, in this rapidly growing metropolis of nearly 400,000 people, second only to Los Angeles in size in the great urban complex which spreads across the Los Angeles basin, oil was the prime moving force which started the city on its way to prosperity, but its development of its waterfront for industrial, shipping, and recreational use is the factor which is bringing it to the fore among the West Coast's great cities.

Aerial view of Long Beach shows relationship of city to harbor. New Pier J development in foreground, and Los Angeles River coming diagonally in from far left. Rainbow Pier with its convention center will be incorporated into the shoreline development plan (see next page).

Since Long Beach at one time was a landing place for contraband in the early days of the state's history, the famous Signal Hill got its name as a point from which signals could be shown to tell smugglers' boats when the coast was clear. By the 1880's the slowly growing town was enjoying some attention as a seaside resort, and a number of piers and hotels appeared along the beach.

It was not until the 1920's that Signal Hill was discovered to be a great dome with fabulous riches in oil beneath it, and the development of the modern city started. A little later, the Navy decided to use Long Beach as a base and the city's modern pattern was set —oil, Navy, shipping and recreation. By World War II a fifth element—aviation—was added with the development of the Douglas Aircraft Plant and associated industries.

Long Beach today is California's fifth largest city, geographically a part of but a separate entity in the sprawling Los Angeles urban complex. Its port facilities and its naval shipyard are the most modern in the U.S., but at the same time it has the world's largest municipally owned marina for small pleasure craft, and the world's largest roller coaster.

Scattered all through these facilities are oil wells, for the land has oil in great pools everywhere beneath the surface, in one of the earth's great fields. In the harbor area, groups of as many as a dozen or more pumps can be seen working in a long row, only a few feet apart. Directly adjacent may be a long wharf with ships loading for Japan, Ceylon, and Melbourne.

Along Ocean Avenue a dozen new or still-building high-rise structures punctuate the skyline, for the city is running short of land. Added to its unusual combination of recreation, shipping and industry, is its share in the second largest economic market in the United States.

Possibly today Long Beach's biggest business is its harbor, which has 52 modern deepwater berths, with plans firmed for 28 more soon. Annually, over 2,000 ships call at the port, more than half of them bearing foreign flags. Cargoes through the port approximated 15 million tons last year, roughly valued at an average of $100 a ton, or one and a half billion dollars.

More money has been spent on the Port of Long Beach since World War II than any other in the nation with the exception of New York, but the port's history goes back to the early 1900's. At that time there were no facilities at all. Ships anchored off shore and lightered their cargoes to land.

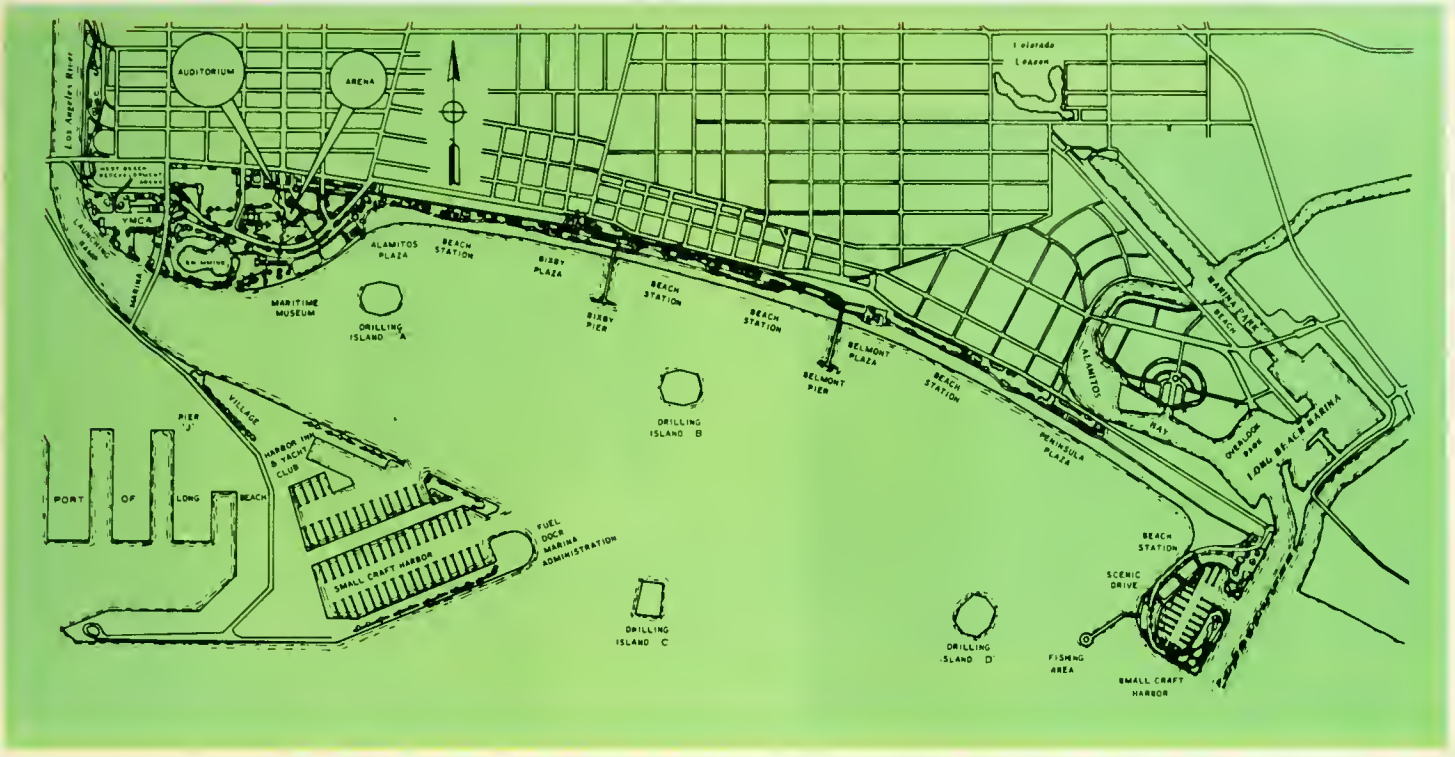
The area encompassed by the joint San Pedro-Wilmington-Long Beach harbor facilities today was then a weary looking expanse of mudflats and shallow estuaries—created through the centuries by the vagaries of the changing channels of the Los Angeles River.

The first contributions came from the federal government, for there was a growing demand for a harbor to serve the Los Angeles basin communities. Then in 1909 the people of Long Beach approved a modest $245,000 bond issue for the city's own harbor, and Pier 1 was constructed. At the dedication a long parade of jubilant citizens marched from downtown to attend the ceremonies at the new pier. Typical of the shipping of the times, the first two vessels to use Pier 1 were lumber schooners.

As time passed, more substantial bond issues were voted, and the mudflats were slowly raised with dredgings from the channels. By 1930 the harbor could berth five large vessels simultaneously. This year also federal funds were made available for construction of a breakwater, creating an outer harbor.

Although Shell Oil had brought in the first well in 1921 at Signal Hill, in 1936 the even richer coastal and offshore Long Beach and Wilmington fields were discovered, and the city owned much of the land lying over them. While military activities during World War II stimulated further harbor development, the oil fields were to prove the city's best source of money for port improvements.

Income from the wells was in the multi-millions, but the wells brought a new problem. As early as 1940 considerable subsidence in certain areas of the harbor complex was being noted,



Map above shows plan for the city's ultimate development of its waterfront through its Pier J and Shoreline Development Plan (city street pattern has been simplified).

and in the ensuing decade the situation rapidly worsened. By 1957 an area of 16 square miles had subsided from 2 to 24 feet. So serious was the situation, the Navy was considering closing its naval shipyard on Terminal Island. Since the yard employed 6,500 people with an annual payroll of $30 million, this would have been a serious blow to the city's economy.

Consulting engineers and geologists called in to study the problem recommended injection of sea water into the subsurface area. In 1953 this plan was adopted, with installation of a pilot waterflood plant on Pier B. Subsidence continued however, and in 1957 the injections were greatly increased. By 1960 a total of 260 million barrels of water had been forced into the ground, and the subsidence was checked.

Nevertheless, the damage was enormous. In addition to the cost of water injection, subsided areas had to be built up again, and when the work was completed, the city found it was out of pocket nearly $60 millions. There was, however, something of a return for this work in that the flooding forced more oil up which would not have been recovered otherwise. This type of operation is now common in the oil fields.

Today the city boasts the largest dry cargo port on the West Coast, with a net operating profit for the port of more than $1 million each year, and revenues are constantly rising. Ports such as Richmond handle greater tonnage, but this is almost exclusively oil, carried through pipelines operated by computers, and is a relatively simple operation.

Great portions of the port have been built with fill dredged from the channels, and places where the ocean waves once rolled in unimpeded are now solid ground and long stretches of piers. Expansion of the harbor by dredging and filling continues, just as the city continues to automate cargo handling facilities, and provide the most modern equipment for moving freight.

In Long Beach Harbor today there are expensive installations for handling all sorts of dry cargo. Among the port's other claims to fame is its shipment of iron ore—greatest in the country—virtually completely automated. One company imports industrial salt which it stores on the pier in great mountains, and moves with big shovels and conveyors. Another has a 24-stories-high elevator exclusively for the movement of grain. The structure holds over 2 million bushels, which it can load into ships at the rate of 1,300 tons per hour. Mile-long freight trains from the Midwest, loaded with milo and wheat, move into position at a hydraulically operated unloader which tilts a car every three minutes and dumps its load on conveyor belts.

Pier E is fitted for super vessels—one of the few facilities in the world suitable for berthing the huge modern tankers of more than 100,000 tons being built today. Great gantry cranes move up and down Pier D loading cargo where they are needed. At the bulk oil terminal on Pier E, pipelines two feet in diameter can suck up 32,000 barrels of crude oil from the huge tankers and deliver it to storage areas.

A $3 million terminal exclusively for handling bananas is the only one of its kind in the U.S., able to take shipments directly from freighters into its processing shed. Its cranes and conveyor belts can handle 100,000 boxes of bananas per eight-hour shift into storage facilities which will take 200 carloads of fruit. About 160,000 tons of bananas are handled each year through this facility, servicing the entire western third of the U.S. and parts of Canada.

Just to the west of Pier E lies the Long Beach Naval Shipyard and Naval Base, now one of the major U.S. shipyards. One Navy crane in use here can lift 425 tons, and the drydocks can handle the largest ships.

Piggyback shipment of truck trailers to East Coast ports is expanding. One company, moving half a million tons of special cargoes annually, operates a fleet of ships which carry the company's own trailers, designed to fit snugly into the holds and on deck. Frozen foods and perishables requiring refrigeration are picked up at the customer's door, and delivered without further handling on arrival on the East Coast. Trailers have their own refrigeration which can be connected to

Looking east on Ocean Boulevard in vicinity of Atlantic Avenue Intersection, downtown Long Beach. Villa Riviera in distance is old landmark, but other high-rise buildings are new.

Monument has been erected to commemorate Shell Oil Company's Alamitos Number One well, which struck first oil from Signal Hill field June 25, 1921.

Coeds at Long Beach College pose to give scale to one of the pieces of modern sculpture on campus.

One of many small craft berthing facilities in Long Beach area.

Long Beach skyline as seen from harbor area.

Beaches are long and wide, with apartment buildings clustered right behind.

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Old photo made in 1923 shows bathing beach, amusement area, and old beach structures. This area has been entirely renovated.

Harbor area as seen from Edison Plant in 1926. Pipes are for dredging operations which even then were creating new land for harbor development. San Pedro and Point Fermin in distance.

the ship's power once the trailer is on board, and constant temperatures maintained.

Included in these loads are frozen citrus concentrates, grapes, prunes, potatoes, melons and shrimp, as well as chemicals, candy, wines, liquors, and other commodities for which the East Coast cities constantly hunger. They arrive in perfect condition, with greatly reduced shipping cost. The company is currently doubling its handling facilities at the port and has plans for larger ships carrying half again as many trailers.

But this is just a minor portion of the truck traffic which operates out of the harbor area. More than 1,000 trucking companies service Long Beach Harbor, and if all the trucks which leave the port each year were lined up bumper to bumper, the line would extend from Long Beach to Chicago. Another 1,300 truck companies serve the city, as well as three railroads, part of the facilities for which are city owned.

The Long Beach Freeway ends at the harbor, handy for truck movements taking ship cargo to further destinations. From this freeway the trucks have access to the state's great highway network. Only a few miles away is the San Diego Freeway, now developing as the major north-south coastal route in southern California. North of Long Beach this route travels through dozens of southern California cities to join the Golden State Freeway at the upper end of the San Fernando Valley. If the driver desires to travel east, he easily reaches the Santa Ana Freeway, which he can take either into downtown Los Angeles, or branch off of it onto other freeways which are part of the Interstate System and go all over the U.S.

Truck travel times have been much facilitated by the freeway system, which in turn is a great help in the rapid movement of materials coming in by ships. By freeway, travel time for trucks from the harbor area to downtown Los Angeles is now less than an hour, only 15 minutes to the Long Beach Airport. Although the San Diego Freeway crosses the northern part of the city close to the airport and Signal Hill, an additional crosstown freeway further downtown is in the planning stage. And as the freeway system is perfected, travel times both to local and distant points are constantly being reduced.

Currently under construction, with tidelands oil money, is the new high-level Gerald Desmond Bridge, which will connect Long Beach and Terminal Island, greatly speeding the movement of traffic through the harbor area, with an interchange at the east end giving direct access to the Long Beach Freeway. Total cost of the project, including construction, movement of disturbed facilities, right-of-way, and similar items, will be close to $20 millions. The new bridge will replace the obsolete and unsatisfactory pontoon bridge which now crosses the harbor entrance channel.

Biggest Long Beach payroll is Douglas Aircraft, with 30,000 employees when operating at full employment. There are dozens of other aircraft and associated industries, as well as numerous plants operated by the big corporation names in America today.

The city's other big industry is tourism, greatly stimulated by Long Beach's own efforts to create as interesting and pleasant an environment for visitors as possible. Developments in this vein include the fine marinas, protection of the city's eight miles of beach, and excellent accommodations.

The city has continued to improve on its image as a sea town. Even the harbor area has been developed as a tourist attraction with its "See-Lane Tour." This is a marked course over

which visitors can drive and see the harbor's main attractions.

One of these is the Pacific Landing complex, with restaurant, boat launching, tackle shop, and sportfishing vessels of all sizes. From these facilities the city claims access to the number one sportfishing area in the world. Here too is an airplane terminal with scheduled flights by seaplane to Catalina Island.

The Long Beach Marina in Alamitos Bay, on the southern edge of the city, is an outstanding achievement with public funds. Here there are berths for more than 2,000 small craft.

A part of this marina is the Leeway Sailing Club, with over 500 junior boating enthusiasts who make up its membership. Youngsters 7–18 attend daily classes during the summer and learn good sailing techniques, good seamanship, and maintenance of sailing craft. Twice each week there are sailing competitions. In the years since 1932 when the club was founded, it has graduated more than 50,000 youngsters from 31 different nearby cities.

Certainly one of the most ambitious projects among western cities is the Pier J and shoreline development plan. With additional fill on the city's side of the Pier J portion of the harbor, the city will create an entirely new marina double the size of the Alamitos Bay Marina, plus motels, restaurants, and yacht club installations. A new bridge will extend Magnolia Avenue to give access.

The present Rainbow Pier at the Civic Auditorium will be eliminated, with extensive fill and pier construction which will provide parking, swimming, more motels, restaurants, a visitors' marina, and a number of other attractions, all imaginatively landscaped. Heart of this section will be the Civic Auditorium and the Arena seating 17,000 people, with 58,000 square feet of exhibitor space.

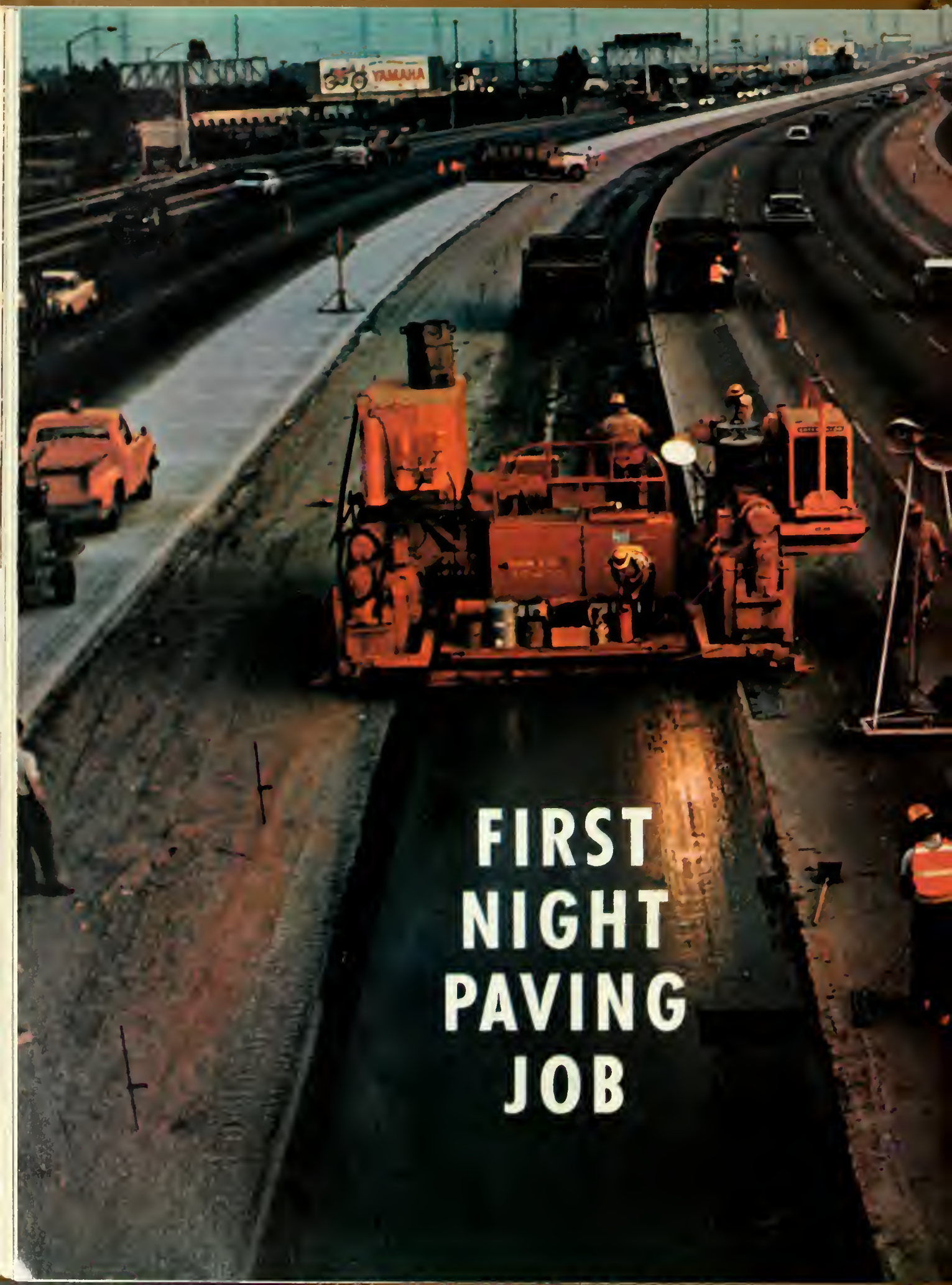
Included also in the Pier J plan and its associated features, eventually representing a $250 million investment, will be a shoreline drive, additional pier facilities and beach developments, and several offshore oil drilling islands. These latter will also be attractively landscaped, so that the drilling machinery will be hidden from the view of those on the shore.

Long Beach today stands on the threshold of becoming one of the West's most imaginative, water oriented cities, rivalling the charm of Italy's Venice and Turkey's Istanbul.

Arrangements have been recently completed for private industry to take over Navy Landing for use as center for oceanography study.

To alleviate parking problem at beaches, city has constructed paved parking lots right on beach.

In canal district of Naples section of Long Beach there are boat berthing facilities directly adjacent to private homes.


350 YAMAHA
FIRST
NIGHT
PAVING
JOB

By Charles F. Gustafson

Twenty-six miles of single-lane concrete poured at a rate of more than 1½ miles a night and completed in 16 working nights was the recent accomplishment on a widening project on the Long Beach Freeway in Los Angeles.

The job was the first nighttime paving ever tried in District 7 and would have taken at least 35 working days to complete because of the heavy traffic using the freeway during the daylight hours.

Working at night not only eliminated interference with heavy daytime traffic but also made it possible to have longer continuous working shifts. Cooler night temperatures slowed down the often too rapid initial drying rate of the freshly laid concrete and contributed to final good paving results.

The Long Beach Freeway, six lanes prior to the widening, carries around 120,000 vehicles on an average day. To handle this growing traffic load, contracts were awarded last December to add two lanes in the median from the San Diego Freeway north to the Santa Ana Freeway interchange—some 13 miles.

However, the problems of paving during the day loomed large.

Since the new lane would be directly against the existing pavement, safety dictated that the inner fast lane of the freeway would have to be closed, funneling traffic down to two lanes in each direction and backing up traffic for the entire length of the job in both directions. Also, with normal 9 a.m. to 3 p.m. working hours (lanes could not be closed during the morning and evening rushes) little paving would be completed in any single working day.

Why not pave at night? the contractors suggested. There would be little or no interference with heavy traffic, longer working shifts and cooler temperatures—thermometers in Los Angeles can hit 95 and higher in June and July.

But night paving was pretty much of an unknown quantity, often considered but never previously adopted in District 7. The difficulties and hazards were apparent. But not overwhelming, said Rich H. Gerald, resident engineer for the state on the project. After discussion and review of signing, lighting and other safety problems, he agreed.

Night paving began June 13. Every week night from 6:30 p.m. to 6 a.m. the lane nearest the median in each direction was closed. Paving operations started about 7 p.m., after the evening traffic peak, and continued to about 3 a.m. They were followed by finishing work and application of curing compound until 6 a.m. The freeway was then opened to its full six lanes for the morning traffic wave.

The paving was laid by two crews, operating two slipform pavers. One crew started work at the south end of the project; the second worked north from about the middle of the job. Completing the new northbound lane, the two crews worked back, paving the new southbound lane.

The two pavers were supplied by a fleet of over 30 dump trucks working out of a centrally located batch plant. The pavers moved forward constantly at 16 feet per minute. The pavers included vibrators, screed and floats so that the continuous slabs 8 inches thick and 12 feet wide were fully completed after the machine passed, except for normal finishing, dragging for texture and the application of curing compound.

In foreground, finishers follow 12-foot slipform paver. Dump truck backs up to deposit batch. Empty truck en route to batch plant.

Dump truck load is dropped in front of 12-foot slipform paver. Vibrator rods agitate batch, eliminate air pockets in shaking down mix. Finishers, rear, smooth newly poured concrete.

The work of each paver was lighted by a portable unit, diesel-power generated, carrying a bank of six 1,000-watt mercury vapor lights on a 28-foot boom. Finishers' illumination was provided by two 500-watt lights on small rolling stands.

Concern over the quality of the finished night paving proved unfounded. The Long Beach Freeway night job proved that a good paving crew with good equipment attains the same high standards day or night. Profilograph (smoothness) readings on the entire job were well within required limits.

Night paving paid the extra dividend of virtual freedom from random cracking. Pouring in the cool evening temperatures avoided the usual sequence of daytime heat expansion and subsequent contraction.

Another worry had been possible accidents during pouring operations. Rubbernecking drivers, it was feared, might slow down and be rear-ended. However, there were no injuries, no fatalities during the night operation, not even a tire mark on the wet concrete.

Finishing against existing pavement. Immediately behind paver, inspectors check concrete for grade.

Ten-wheel dump truck deposits load in front of moving slipform paver.

The only major incident directly chargeable to the night job was the blacking out one evening of portions of the Cities of Compton and Long Beach. In moving one of the light towers which illuminated the paving area, the boom snapped an overhead power cable. Freeway traffic was halted only long enough to determine that the broken cable across the lanes was the dead end, rather than the hot line.

The resident engineer and his inspectors were on 6 p.m. to 6 a.m. shifts. One of their most important duties was supervising the placing of warning signs for approaching traffic. Three warning signs, each illuminated by two 500-watt floodlights, were placed at 1,000-foot intervals in advance of the operation. Flares, directional arrows and cones then narrowed traffic to two lanes on the near approach to the actual pouring site.

Above: Paving machine operator checks area just ahead of slipform.
Below: Slab of freshly poured concrete stretches out behind paver in distance. Completed section at left of excavated median.

Widening of the Long Beach Freeway is being done under two contracts. From the San Diego Freeway north to Bandini Boulevard, a 12-mile portion was awarded to Kasler Corporation and Gordon H. Ball Enterprises for $3,659,283. The second section, about two miles long, from Bandini Boulevard to the Santa Ana Freeway, is under construction by MacDonald & Kruse Inc. on a $2,833,962 award.

In addition to the new lanes, the project requires the changing of all drainage facilities, widening 12 bridges along the route, and installation of a blocked-out metal beam barrier in the median. Adding to safety and driving convenience is a two-foot glare shield atop the barrier to screen off headlights of oncoming cars. Job completion is scheduled for early 1967.

Simi Valley Freeway

By Charles F. Gustafson

Above: Valley beauties smile as they detonate dynamite charge. Below: Chumash Indians in authentic costumes put on dazzling display at celebration.

A century ago the Simi Valley was isolated, remote, almost inaccessible. A rocky trail led to the San Fernando Valley to the east. To the west, north and south were hills, high mountains, sandy stretches of virtual desert.

Once a day, to serve the scattered ranchos, a branch of the famed Butterfield Stage ran from Santa Barbara through the valley and over Santa Susana Pass to a connection with the main line near what is now Pacoima.

Today, in the Simi Valley, the hills, the high mountains and the sandy stretches remain. The trail to the east is a two-lane highway which twists over the pass on an alignment selected in 1915. But the last Butterfield stage ran long ago. There are no successors . . . no passenger trains, no buses, no form of public transportation.

You motorize, if you settle in the Simi now. In 1966, forty thousand people have. And more come all the time.

* * *

The word *Simi* is from the Chumash Indian *shimiji*, said to mean fleecy white clouds. The Chumash were hunters and fishermen who also scratched a few crops into the soil and ranged the coasr and inland areas south from about present San Luis Obispo. But the valley name of Simi is just about all, aside from a spectacular array of paintings on cave walls high in the mounrains, that remains of this gentle tribe which inhabited the area prior to the coming of Spanish soldiers and Franciscan fathers early in the 19th century.

In rhe 1850's the valley was part of a large Spanish rancho owned by the de la Guerra y Noriega family of Santa Barbara. Then the railroad rate wars of the 1880's hrought hundreds of immigrants from the eastern United States. Farmers raised hay and grain, sheep, cattle and blooded horses. Orchard crops included apples, peaches, pears, figs, plums, olives, pomegranates. Great vineyards supplied grapes for locally famous wines.

During and after the rate wars, prospective settlers of Simi Valley land were carried by stage from the rail line at San Fernando. The trip over the pass was described as a hair-raising experience, with the screams of terrified lady passengers echoing from the canyon walls as rhe stage drivers, cracking blacksnake whips, urged their beasts through the sreep and narrow defile.

This tranquil, fertile plain of unspoiled natural beauty, ringed on all sides by its mountain guardians, preserved its rural atmosphere all through the 1940's. Population in 1950 barely exceeded 3,000.

Blast on mountainside signaled beginning of celebration *(see previous page)*

State sign route 118 threaded Santa Susana Pass amid a scenic background familiar to all western movie fans. Los Angeles Avenue ambled through the small settlements of Santa Susana and Simi and west to the coast between walnut and citrus groves, orchards of apricots and peaches, fields of tomatoes and peppers. Sheep and cattle grazed on the green hillsides.

* * *

Then, in rhe late 1950's, the spillover from the bursting San Fernando Valley swept through the once quiet pass. By 1960, population had reached 8,100. In July, 1962, it had leaped past 15,000; in July, 1963, 24,000. In July, 1964, 33,800. In December of 1965 the population of the Simi Valley was estimated at well over 40,000!

In the years 1960–65, the Simi Valley was rated the fastest growing section of Ventura County, itself one of the nation's leading growth areas. In the 12 months preceding July, 1965, population jumped 24.7 percent—and this was the smallest percentage increase for any single year since 1960. In five years, the Simi Valley showed an overall population increase of about 550 percent, or an average 110 percent per year.

The number of cars on the road soared in pace with population figures. Since rhe area lacked public facilities, every adulr needed personal transportation for work, shopping, recreational and cultural pursuits; in short, for every activity which took him beyond the confines of his own half-acre.

Two-lane Route 118 (Los Angeles Avenue) continued to be the only continuous east-west route through the valley. In 1965 traffic density on this once quiet roadway showed daily traffic counts at such typical intersections as Erringer Road in Simi, 22,900; at Kuehner Drive near Santa Susana, 27,-300; on the other side of the pass at the junction with Route 27, 23,500.

But the real bottleneck was the highway through Santa Susana Pass. Improved and widened to provide passing lanes on the upgrade at several points, it followed of necessity the multiple switchback alignment established a half-century earlier. Precipitous terrain permitted only minor improvements in its traffic-handling capacity.

* * *

Of the 18,000 people in the Simi Valley who go to work every day, less than 1,500 are employed in rhe valley itself. Most travel to jobs in the San Fernando Valley.

As the traffic load built up, the resulting twice-a-day congestion on the highway and through the pass cost time and money and tempered the enricing advantages of the semirural valley. Even between rush hour periods conditions were less than ideal. On weekends, more and more Simi Valley residents tended to stay quietly at home, and found that friends and relatives from "outside" tended less and

Left: Color guard of the Ventura County Independent Riders was also present. Left lower: Honored guests arrived by Conestoga Wagon.

less to make the drive to visit them. Weekday evenings only the hardiest fans traveled from the valley to sports, musical and other entertainment events outside the mountain ring.

There could be no return to the agricultural base of the past. Now, a commuting economy had seemingly peaked. More people on the present roadways threatened total immobility.

To the men whose vision and energies had contributed mightily to the Simi's unparalleled growth, a sound industrial base for the valley was the practical solution. If they could stimulate locally based research and development enterprises, technical product manufacturers, light assembly operations, and similar technological age activities—this would enable the great majority of valley workers to capitalize close to home on their varied skills.

Industrial parcels had been zoned in the west end of the valley—flat, well drained, abundantly served by all utilities. A vigorous campaign was mounted by the Simi Valley Chamber of Commerce to lure industry.

And industry was interested. Plant location teams came to see and learn more. They liked what they found. But few final decisions were made in Simi's favor. Modern industry demands mobility for workers and goods, ready access to markets and manpower.

The Simi was caught in a vicious circle. Until highway congestion was relieved and the area made easily accessible at all times, new industry was not likely to be attracted. Until new industry created new local jobs, roads would be congested with people driving to work outside.

A small but disquieting number of people found traffic intolerable, talked of moving away. It was a situation which could build up to alarming proportions.

* * *

But plans to improve the situation were already well along in the Division of Highways building in Los Angeles. The route of the Simi Valley Freeway, stretching for over 53 miles in Ventura and Los Angeles Counties, had been adopted by the California Highway Commission in a series of actions concluding in December, 1964. Generally paralleling Los Angeles Avenue from Saticoy to the Santa Susana Pass area, the adopted route hugged the foothills of the San Fernando Valley on its way to its eastern terminus at the Foothill (Route 210) Freeway near Sunland.

With its narrow road winding through uptilted terrain and the fantastic rock formations dear to moviemakers since the days of Bronco Billy Anderson, Santa Susana Pass was the key to the entire route. Preliminary design plans for this section had begun in 1961.

The 1965–66 fiscal year highway budget included the initial construction of six lanes of new alignment through the pass. About $9.5 million was allocated, and in January, 1966, the commission provided additional funds for the project. The Division of Highways conducted extensive drilling operations in the pass area to evaluate earlier findings on the geological structure. Clearly, construction would involve extensive blasting and the movement of vast quantities of earth and hard rock.

In late March, 1966, bids were opened on the job, and subsequently the contract was awarded to Kirst Construction Co. of Altadena, which had made the low bid of $14.5 million.

In the Simi, a blue ribbon committee completed plans for a five-day gala celebration, to be climaxed April 23 at groundbreaking ceremonies at the west project limit on Kuehner Drive.

HOORAY!!! SIMI VALLEY FREEWAY UNDER WAY!!!

The triumphant message blazed throughout the Simi days before the actual groundbreaking. Flags, banners, billboards, posters, bumper stickers, lapel pins, blossomed on all sides.

Saturday morning, April 23, was warm and clear. In the lush green meadows alongside Kuehner Drive, hundreds of Simi Valley residents and visitors mingled with colorful groups of Sioux and Blackfoot Indians, Old West gunfighters, horsemen.

The program opened with a gun battle by the Simi Valley Gunfighters worthy of the goriest TV western, a symbol of the valley's link with the Old West. Then the color guard of the Ventura County Independent Riders escorted the dignitaries, arriving in a Conestoga wagon which had in fact carried an early settler's worldly goods into the valley in the 1850's.

John C. Montgomery, Ventura County Supervisor and master of ceremonies, introduced Director of Public Works John Erreca, representing Governor Edmund G. Brown. Erreca reviewed the chain of events which had preceded and now found focus in the morning's events. He recounted the value of the coming freeway in lives preserved and in time and money saved in the years ahead; its economic significance to the people of the valley; and ended with the request that he be invited to the dedication ceremonies in 1968. The invitation was extended, and accepted, on the spot.

Other speakers of the morning included Senator Robert J. Lagomarsino of Ventura County, Senator Alvin Weingand of Santa Barbara County, and Assemblyman Burt Henson of the 37th District.

Edward T. Telford, District Engineer, Division of Highways, added to his brief remarks the tongue-in-cheek suggestion that the present two-lane highway over the pass be preserved for posterity as a historical monument to the fortitude and patience of the valley residents. Immediate loud applause by those who twice daily traveled its twists and turns indicated that his whimsical recommendation may gain a lot more support than he ever intended.

Then all eyes focused intently on the mountains looming high to the east over the festivities. Three Simi Valley beauty queens detonated a blast which, far up the hillside and directly on the centerline of the future freeway, dynamited tons of rock and an immense plume of white smoke into the air.

After the booming report echoed down the lovely valley, war and hunting dances by the Many Trails Club representing 30 Indian tribes continued through the morning. The visiting dignitaries once again seated themselves in the jouncing Conestoga wagon and set off for the invitational luncheon which ended the groundbreaking ceremonies.

But throughout the Simi Valley itself the "Open Door to Opportunity" celebration never faltered for a moment. Carnivals, rodeos, community dances, moonlight trail rides and barbecues; flower shows, hobby and crafts fairs, outdoor art exhibitions—all were part of the tumultuous gala which enthusiastically welcomed the advent of the long-awaited Simi Valley Freeway.

* * *

To achieve present-day standards in its leap across the mountaintops, the Simi Valley Freeway has of necessity abandoned altogether the 1915 alignment through Santa Susana Pass. The result is one of the largest projects the Division of Highways has undertaken in Ventura County. Earthmoving statistics are impressive: Excavation of more than 8.5 million cubic yards of earth for roadway (some rippable, much requiring blasting). Over 34,000 cubic yards for structure excavation. The compacting of 108,200 square yards of original soil.

To withstand the crushing weight of fills ranging up to 220 feet in depth, reinforced concrete drainage structures of special high-arch design are being built. In some areas, the unique rock strata require a 3-to-1 slope. The right-of-way at its widest point is 1,100 feet from top of cut to top of cut.

This initial project to conquer the rugged and picturesque Santa Susana Mountains is on schedule for opening to traffic late in 1968. Immediate construction includes 1½ miles of four-lane highway on Santa Susana Avenue north from Devonshire Street, as an extension of Route 27 (Topanga Canyon Boulevard). This work, to relieve traffic congestion on the existing two-lane roadway, will be completed by the end of 1966, joining the present pass road just south of its "S" curve over the Southern Pacific rail tunnel. Subsequently, this extension will climb an 8-percent grade to an elevation of 1,232 feet at the interchange of Route 27 and the Simi Valley (Route 118) Freeway. Construction also covers grading work for 0.7 mile at the east end of the project to a point north of Variel Avenue to "balance out" the project.

Crossing the mountains, the new freeway marches up a 3.6-percent grade to reach its highest elevation at 1,568 feet virtually on the Ventura-Los Angeles county line. A short distance west, near the point where an access road to existing Los Angeles Avenue soars 30 feet overhead, the six-lane freeway begins its descent on a 5-percent grade to the Keuhner Drive project limit.

In the Ventura County "hard rock" terrain, even the new and powerful single-shank rippers on the job cannot cope with the rock density. So, day after day, the jagged hills which once echoed only to the soft tread and twanging bow of the Chumash hunter now resound to the deafening chatter of 3-inch holes being air-drilled to a depth of 15 feet, followed by overnight blasting.

Near Keuhner Drive, scrapers climb 32-percent grades and descend them again to deposit fill hundreds of feet below the loading area. Dragging their pans down the steep slopes, the huge scrapers are enveloped in clouds of dust and the white smoke of metal biting deep into hard rock.

Building the Simi Valley Freeway's next section west from Kuehner Drive —through level terrain to Tapo Canyon Road in Santa Susana—is expected to be funded in the 1967–68 fiscal year budget. Completion is planned for late 1968 to coincide with the opening to traffic of the initial project through the mountains. The next extension of Route 118 will be to First Street in Simi.

Meanwhile, to relieve valley internal congestion, Los Angeles Avenue is being widened from two to four lanes from Smith Road, near the east ascent of the pass, to Tapo Street in Santa Susana, 3.3 miles. Similar widening of a five-mile stretch between Tapo Street and Tierra Rejada Road is scheduled for completion in mid-1967.

An alternate route from the Simi to the Conejo Valley and Route 101 (Ventura) Freeway will also be open to traffic in the late fall of 1966. This federal aid secondary highway project will extend Olsen Road from the vicinity of Thousand Oaks to the Simi Valley's Madera Road. Traversing presently inaccessible country, Olsen Road's scenic attractions will rival those of the spectacular Santa Susana Pass country.

The Simi Valley Freeway will carry its first traffic through Santa Susana Pass in late 1968. But its impact on the economic future of the communities of Santa Susana and Simi (possibly then united into a single incorporated area) has long been discussed and eagerly anticipated in every circle.

Simi Valley leaders are well prepared to meet the challenges inherent in economic expansion. Time and again in the past decade they have planned and successfully executed the programs which have met the realities of a truly fantastic growth.

A population of 85,000 in 1970, and approaching 200,000 in 1985, is the conservative forecast of demographers speaking from the basis of today's 40,000-plus population. Growth like that means homes for thousands of new young families. New residential developments. New shopping centers. New and expanded educational, cultural, and recreational facilities. And, above all, to make it economically feasible, new industry.

Simi Valley in its remarkable 15-year growth from 3,000 to over 40,000 people has attracted a young population. Currently 70 percent of the residents are under 35. One-third of the population goes to school. Over 30 percent are under 10, only 3 percent over 50. These young families, 4.3 persons per home, average an annual income of $8,100. It is expected that young and growing families like these will make the major contribution to the valley's growth in the next two decades.

All concerned agree that new industry must furnish the sinews to support the Simi's rosy future. What does the

Director of Public Works John Erreca represented Governor Edmund G. Brown at groundbreaking ceremonies.

valley offer? First, close proximity to the Los Angeles-Long Beach metropolitan area, America's No. 2 market. Then, an extensive and eager pool of scientists, engineers, technicians, and similarly skilled personnel. And plant sites 40 miles from Los Angeles, 30 miles from Port Hueneme (the only deep sea port between Los Angeles and San Francisco), 35 miles from Los Angeles International Airport and the quick access it offers to jet-near world markets.

In the western end of the valley, over 400 acres of flat and well-drained land have been zoned for industrial use. The parcels range from 2 to 165 acres, adjacent to the Southern Pacific main line and the Simi Valley Freeway's future junction with First Street and with Madera Road, the connection south to Thousand Oaks and the Ventura (Route 101) Freeway. An additional 90 acres are reserved for later expansion. Several industrial parcels, totaling 75 acres, also well served by rail and truck lines on a daily basis, have been zoned in the Santa Susana area, near the future freeway interchange with Tapo Canyon Road in the east end of the valley.

Investor-owned utility companies have facilities to handle any industrial application requiring electric power and natural gas service. Telephone service includes ultramodern equipment, with almost all installations underground.

Metropolitan water district pipelines carry across the valley an ample supply of good water under gravity flow pressures adequate for all peak demands and for firefighting requirements. Feather River water will supplement and ultimately replace the present Colorado River sources.

By the mid-1980's, research and development laboratories, engineering and technical manufacturing, light assembly operations and similar activities will provide the major sources of employment in the valley. Seeking these bright opportunities will be a steady influx of new residents, eager to share the cool, clear summers, the mild winters.

So educational facilities must expand, too. Here, Simi Valley school leaders are practiced hands. The present modern and efficient public school system serves an enrollment which has increased over 500 percent in the past five years. It includes 16 elementary schools enrolling 10,000 children, three junior high schools enrolling 3,000, a senior high school enrolling 2,000. An excellent and complete adult education program is maintained five evenings each week throughout the school year. The total of 15,000 daytime students is expected to increase to at least 25,000 by 1969. The plans to accommodate them are ready.

A few miles west of Simi, the Moorpark Junior College is scheduled to hold its first classes in September 1967. The second junior college in Ventura County, it is now being erected on a 134-acre site. The initial six buildings, constructed at a cost of about $8,000,000, will serve about 2,000 students. A daytime and evening enrollment of approximately 10,000 students is anticipated by 1970.

Nearby, in Thousand Oaks, is California Lutheran College, a four-year fully accredited institution. Ventura Junior College, in the City of Ventura, is about 35 miles distant.

In its residential area development, care has been taken to provide ample recreational facilities. Park land has been set aside by the Simi Valley Park and Recreation District for 13 fully developed parks.

Nearly 100 service clubs, fraternal and social groups, and other organizations are active in the valley. There are about 40 churches, representing all faiths.

The new Simi Valley Community Hospital of 50-bed capacity was recently completed at the north end of the valley. The complete modern facilities, including several operating theaters, are expandable to 150-bed capacity when needed. Medical and dental services in the valley have been excellent for many years.

Perhaps the scope of valley ability to plan for the multiple daily needs of its future residents is best illustrated by its present and proposed shopping centers. Because Santa Susana and Simi were originally about four miles apart and began to expand notably toward each other only in the past five years, there is no single "central" shopping district. Rather, many shopping districts of varying size are scattered throughout the area. Retail and service establishments now total nearly 800.

Plans for additional shopping centers are on the drawing board, scheduled for construction in the early 1970's but ready to be advanced quickly as population and demand arise. A typical development will include department stores, major food markets, other retai

stores, professional and civic administration offices, theaters, motor hotels, restaurants and banking facilities.

Strategically located regional "village centers" on 60- to 100-acre sites will prove major attractions for the combined populations of Simi and Santa Susana, nearby Moorpark, and the Conejo and Santa Clara River Valleys.

Planned projections of smaller neighborhood centers include drug and specialty shops on two- to five-acre sites, retaining so far as possible the open rural atmosphere which, it is hoped, will continue to be characteristic of the valley.

"When the freeway comes . . . "

The Simi Valley Freeway is an important segment of a nationwide highway system which provides speed, safety, convenience and economic advantage in moving masses of people and goods. But, to the individual citizen, "when the freeway comes" has its own special significance:

To the mother whose school-age children walk quiet streets freed from fast through traffic; to the worker who finds the job precious minutes nearer; to the shopper who again parks close to favorite neighborhood stores; to the homeowner who sees his property increased in value; these are the benefits which loom large because they are daily, and personal. And perhaps it is in these terms that the meaning of its new freeway to the Simi Valley will best be expressed.

Above: One of the new high schools recently built in the valley. Note housing tract in distance. Left: Aerial view at foot of Tapo Canyon looking north, near west end of Santa Susana, shows transition area between housing and agriculture.

Construction work for new freeway will pass close to old route. Note string of traffic on old road held up by small car laboring up grade.

Football team turns out for fall practice at Simi Valley High School.

Johnny Lupineseed

by Marcia J. Mickelsen

John Brown, Sr., the senior highway superintendent in District 1, Eureka, has been informally dubbed "our own Johnny Appleseed of the north." The only difference is that the roadsides he frequented are sprouting yellow lupine, not apple trees.

Brown has been working at making lupine grow on the sandy, barren stretches of roadside near Eureka for 30 years.

He became interested in using the bushy plant for erosion control when he noted the earlier success of the Hammond Lumber Company (now Georgia-Pacific) in tying down the shifting sand slopes that were located on the right-of-way for the logging railroad that once ran along the beach between Crannell and Samoa.

Yellow lupine had graced the right-of-way here since the late 1800s; it seemed to grow well in the sandy ground without much tending, and it obviously fended off the destructive forces of the ever-blowing staunch sea breeze.

Why, Brown reasoned, couldn't lupine stabilize the highway slopes paralleling the railway to the east? In his spare time, he began experimenting, with many admitted failures. Lupine, like everything else introduced to this sand-without-soil, was not always obliging.

He had precedent in his first failures, however, because John McLaren, noted Superintendent of San Francisco Parks, had the same trouble with the temperamental plant.

McLaren tried to use lupine to tie down the moving mass of sand that formed the western edge of Golden Gate Park. After he and his staff met with no success, they finally held and bound the dunes from drifting by planting bent sea grass imported from France.

In contrast, Brown persisted in his efforts with lupine. The lumber company had demonstrated that it could be done.

In time, Brown did learn how to make the lupine grow. Always involved with maintenance work during his long highways career, he found occasional help in his department. In wet weather, when the regular work was impossible, Brown sent otherwise unoccupied men out to gather lupine seedpods. Later, he sent them back to sow the seeds when conditions were right for germination.

Mr. B. A. Hemenway originally, and later Mr. Frank Coleman (both highway tree maintenance foremen, and both of whom worked under Mr. Brown's supervision), also became intensely interested in the lupine and helped considerably in getting it established.

Brown's hankering to see lupine succeed was entirely personal; he had only tacit approval from his supervisors. Without any money or the spur of official administrative encouragement, Brown managed to establish several "stands" of yellow lupine. The plants, with their identifying yellow spikes of flowers, first appeared on Route 101 in the early thirties after a WPA crew had widened the road's shoulders.

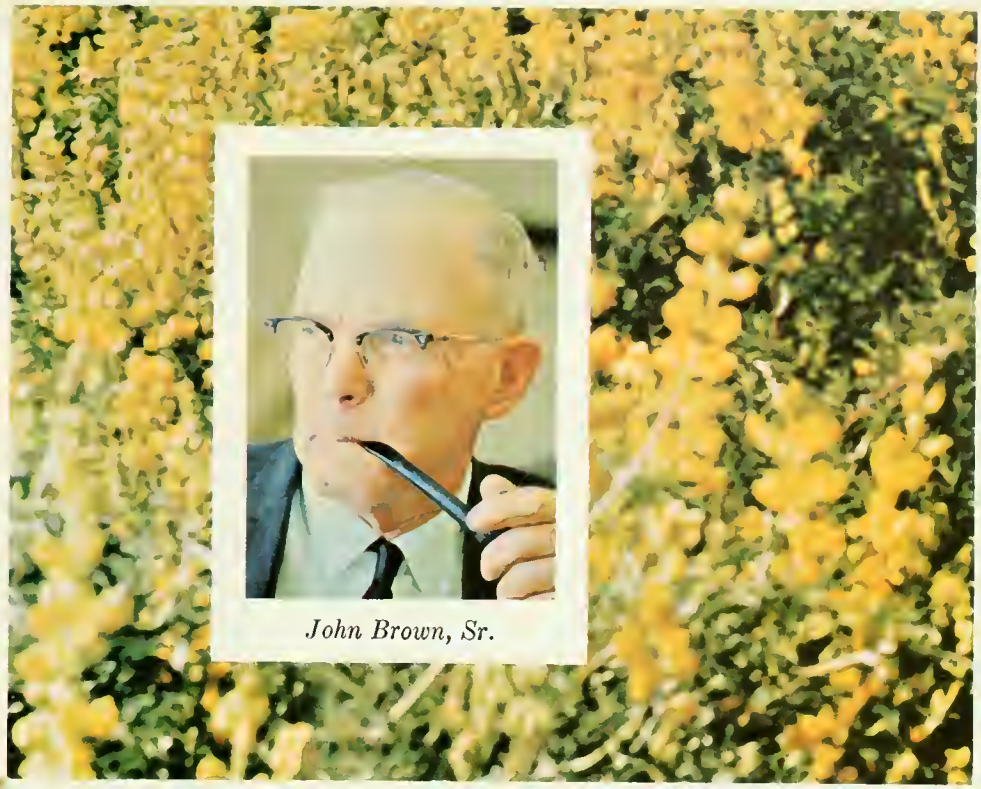
Today, due to Brown's perseverance, about 35 miles of yellow lupine line the roadsides of US 101 in and around Eureka. In the summer, they make an unusually spectacular frame for magnificent Trinidad Head. On Route 1, in Mendocino County, another 10 miles of scattered lupine plantings provide a blaze of color to motorists for almost three months of the year; these, too, are Brown's work.

After all this experience, Brown still terms yellow lupine a "temperamental ornery plant that requires its own type of soil and its own climate. Even with planting at the proper time, it may not grow."

But comment from travelers and others who saw the colorful slopes brought Brown's efforts into the limelight. Three years ago, his lupine planting was recognized by the inclusion of erosion control funds in the maintenance budget to allow for the gathering and planting of these seeds.

The seed collecting and planting operations are not expensive. It costs from four to five dollars to gather a pound of seed, as abundantly supplied by nature. By way of comparison, commercial seed suppliers offer erosion control mixtures at a retail price of $25 to $35 per pound.

Even when lupine is established, it may have other problems. Aphids sometimes attack and reduce the plants to brown stubble. Although this is far from ideal, there are certain advantages because, as legumes, lupine roots deposit a tremendous amount of nitrogen in the soil. Once the nitrogen is there, it is possible for other plants to grow. After lupine succumbs to foes like aphids or root grub; grasses, native woody plants (*Baccharis* and *Ceanothus*) and even forest cover can adapt to the enhanced soil. The cycle from sandy, barren soil to a cover of fir and pine is a lengthy one, but the addition of nitrogen attracts enough plant life to keep the soil from eroding while the long process takes place.



John Brown, Sr.

Photograph of Johnny Lupineseed is framed by Lupinus arboreus, or yellow tree lupine, botanically described as a shrubby perennial, four to eight feet high. A beautiful plant with rather light green foliage and rich sulfur yellow, fragrant flowers. At left, is photo of Brown's hands holding quantity of seeds. Below is a portion of an eight-mile stretch of US 101 north of Eureka where three-year-old plants provide color throughout the spring and summer.

Bridge Design Awards

Above: W. James Jurkovich, grand prize winner.

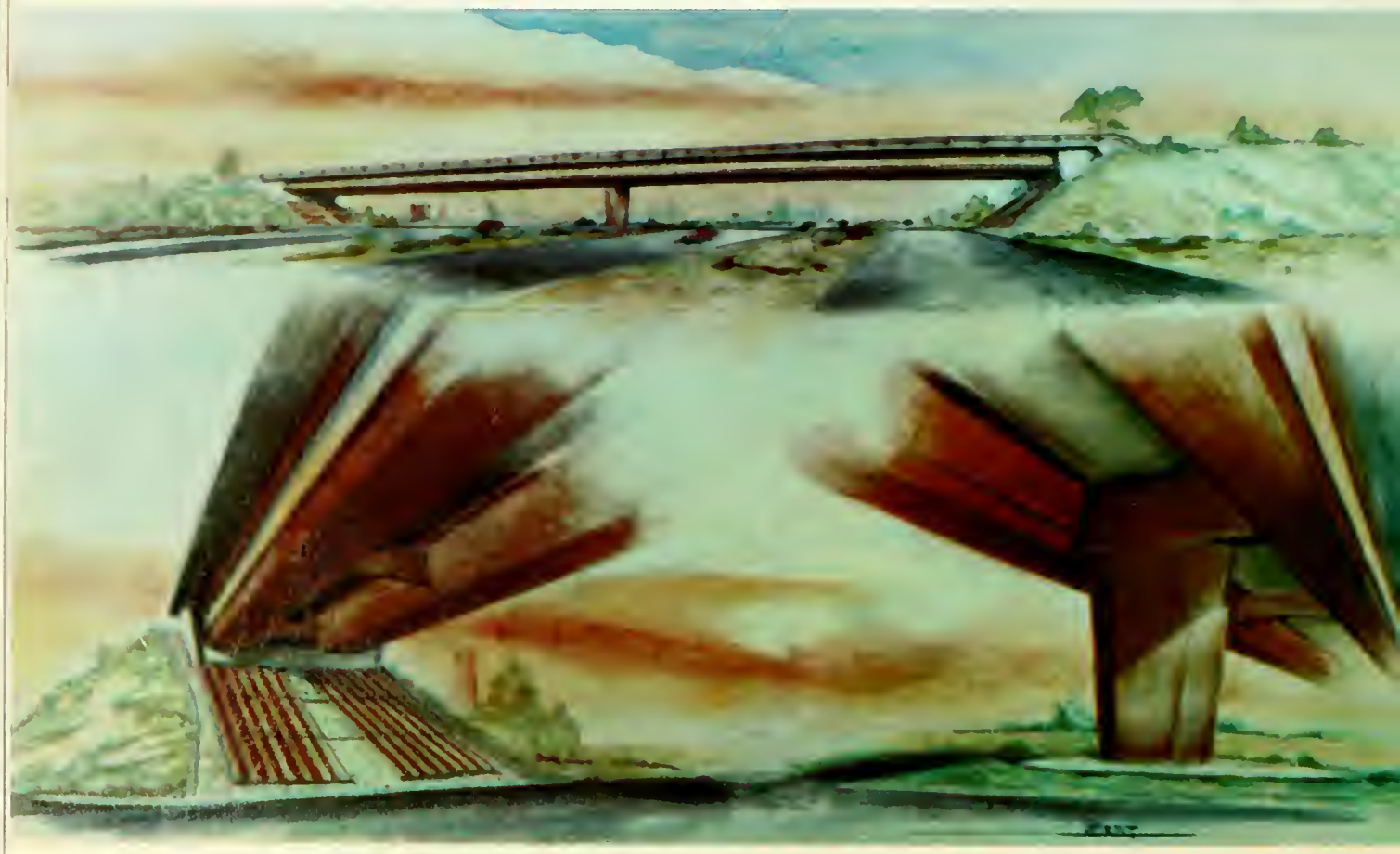
In September a California Division of Highways bridge engineer received the welcome news he had won $15,000 as first prize in the U.S. Steel Corporation 1966 International Bridge Design Contest. The talented winner was W. James Jurkovich, a senior bridge engineer who heads a design section in the division's Sacramento headquarters.

Second prize went to a New Jersey engineer, and third prize to a New York engineer. Of the 10 honorable mention awards, each bearing a $1,000 prize, 5 were also won by employees of the California Division of Highways Bridge Department. All the other honorable mention awards went to engineers in foreign countries.

The aim of the competition was the development of new ideas, design concepts, methods, and different uses of material to benefit design engineers and consultants throughout the world. Entries were judged on originality of design, good utilization of steel, economy in design and fabrication, and esthetic appearance of the total structure.

Each contestant worked on the same problem—design of a two-lane overpass across a four-lane freeway with frontage roads located on level ground. Although the problem was a hypothetical one, drawings for the finished design had to be so complete that a construction crew could build the structure.

Below: Rendering for Jurkovich's design which won first prize of $15,000.



lter W. White, Rio Linda.

H. L. Payne, Sacramento

O. Bender, Sacramento

A. P. Bezzone, Sacramen

Robert E. Kerswah, Yuba City

Earl R. Latham, Davis

Richard J. LeBeau, Citrus Heights

Photos above are of the seven young Division of Highways engineers who shared in the five $1,000 awards.

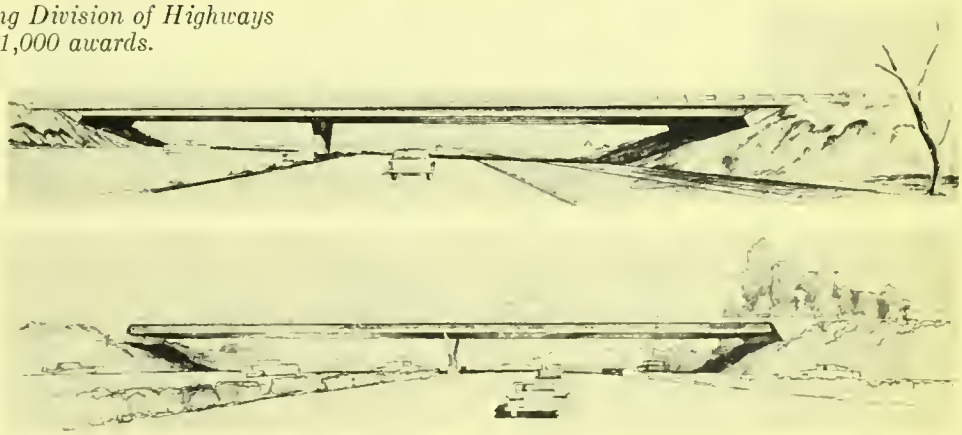
The California honorable mention award winners were:

- The team of Robert E. Kershaw, 1255 Rickey Drive, Yuba City, and Richard J. LeBeau, 5422 Sagitarius Way, Citrus Heights.
- Earl R. Latham, Willowbank 10A, Davis.
- The team of O. Bender, 5508 Prim Court, Sacramento, and A. P. Bezzone, 2183 56th Avenue, Sacramento.
- H. L. Payne, 1225 56th Avenue, Sacramento.
- Walter W. White, 7408 16th Street, Rio Linda.

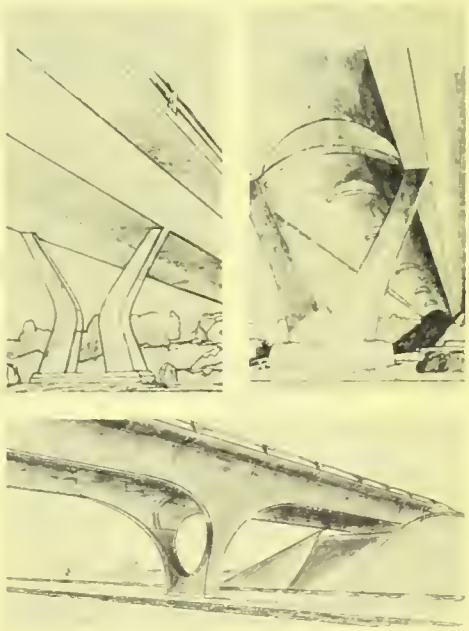
Governor Brown commended the winners and cited their accomplishments as "proof that strong progress is being made in blending safety, beauty and economy in the state's public construction program."

Jurkovich is a native Californian. Born in Fresno, he graduated from high school there and attended the University of California, where he worked his way through school and still found time to letter in football and track.

Upon graduation, he spent three years in the Army Engineers before joining the California Division of Highways in 1946.



Drawings are details from some of the winning designs submitted by men shown above



He was promoted to senior bridge engineer in 1952 and heads a design section that specializes in major projects such as the Vincent Thomas Bridge near Los Angeles.

Married, he and his wife and five children reside at 2170 56th Avenue, Sacramento.

Highway Commissioner James A. Guthrie Dies

Served Under Three Governors

James A. Guthrie

James A. Guthrie, member of the California Highway Commission for the past 23 years, died on August 23 in San Bernardino.

Guthrie, a Republican, was reappointed twice by Governor Edmund G. Brown, in 1961 and 1965. His original appointment to the commission was made in 1943 under Governor Earl Warren. He served several terms as vice chairman.

In reappointing Guthrie for the second time in 1965, Governor Brown said: "Jim Guthrie has been a pioneer in highway development through three administrations and has played an integral part in shaping our transportation system. I feel we need his help in planning for the growth of the future."

Guthrie was born in San Bernardino in 1888 and lived there throughout his life. He was editor and president of the San Bernardino *Daily Sun and Telegram* for many years. Guthrie through his newspaper was one of the leaders in the first good roads program for San Bernardino County before the state highway system was so widespread. He pioneered in the development of the roads now known as U.S. Highways 66, 91 and 99. These routes are now part of the Interstate system.

Guthrie was past president of the San Bernardino Chamber of Commerce and a former director of the state chamber. He was a member of the advisory board of the Automobile Club of Southern California, the California Club of Los Angeles and the Sutter Club of Sacramento.

He is survived by his wife and a son, James K., of San Bernardino.

The following statements reflect the feelings of close associates of Guthrie.

Robert B. Bradford, Transportation Agency Administrator and Chairman of the California Highway Commission, said: "Few taxpayers could really know how much over a 23-year period Jim Guthrie contributed to the integrity and quality of the state's highway program."

John Erreca, Director of Public Works, stated: "Every Californian who owns an automobile lost a friend when James A. Guthrie died. Long before his appointment to the California Highway Commission he directed much of his time toward making sure that Californians would have available to them the best possible network of state highways, county roads and city streets. He was remarkably successful in not only this, but in the other varied public service projects he undertook during his many fruitful years."

State Highway Engineer J. C. Womack stated: "California lost a real friend when James A. Guthrie passed away. Much of his adult life was devoted to public service. He was keenly interested in good roads and his constructive efforts were a positive factor in the development of our state highway system. The California Division of Highways will miss him."

And from his fellow commissioners:

Joseph C. Houghteling, Sunnyvale: "It was an honor to serve on the same commission with such a distinguished Californian and newspaper editor as James Guthrie."

Roger S. Woolley, San Diego: "James Guthrie epitomized all that is balanced and progressive in the California scene. He led an envied life that all of us should emulate."

Abraham Kofman, Alameda: "The passing of James Guthrie is a loss not only to me as a member of the commission but to each of the state's residents who is now benefiting from Mr. Guthrie's long years of service."

Alexander H. Pope, Los Angeles: "As the most newly appointed member of the commission, I shall miss the wisdom and experience that James Guthrie's 23 years of service provided to the other commissioners."

William S. Whitehurst, Fresno: "He was a man of such stature that his passing is a loss that California can ill afford."

Alfred Heller ——— *"He was a dedicated public servant, a man I am proud to have known, albeit only briefly."*

Frank B. Durkee ——— *"Above all, Jim Guthrie stood for progress; for what he believed would be beneficial for all the people—whether it be water for San Bernardino or a freeway system for California, subject always to fair treatment for individuals or communities affected. It was an honor to have served with him."*

Franklin S. Payne ——— *"Jim Guthrie was one of the finest and most honorable men I have ever known. He was the most outstanding member the California Highway Commission has ever had."*

Fred W. Speers ——— *"Jim Guthrie was, in my opinion, one of the great men of California who truly matched its mountains."*

C. T. Leigh ——— *"It was a privilege to have known and worked with Jim, and continued a friendship for many years after serving on the commission."*

Robert E. McClure ——— *"Jim Guthrie to his many friends and colleagues—was one of the great twentieth century builders of California and truly a man 'to match our mountains.'"*

H. Stephen Chase ——— *"Of the many privileges coming my way as a result of service on the Highway Commission without a doubt one of the greatest was my association with Jim Guthrie. His wisdom and friendship I shall always remember and cherish."*

Arthur T. Luddy ——— *"The passing of Jim Guthrie has grieved and saddened me. My fondest memory will always be my association with him on the Highway Commission."*

F. Walter Sandelin ——— *"Jim Guthrie, he was a true and loyal crusading Son of California."*

C. M. Max Gillis ——— *"He possessed good qualities in unusual measure—strength, gentleness, integrity, and wisdom—a truly big man."*

John J. Purchio ——— *"The passing of Jim Guthrie takes from all of us in California one of its finest people and most able citizens."*

John O. Bronson ——— *"Jim Guthrie was a credit to the Highway Commission. He was fair and honest and used excellent judgment in his decisions."*

Harrison R. Baker ——— *"He was an outstanding citizen of California, one of the finest of this generation, a powerful and continuing progressive force in his community."*

T. Fred Bagshaw ——— *"He was great in every aspect—to his family—as a friend—as a public servant."*

"Well Done"

In the first such action of consequence since 1951, the Division of Highways in September resumed control of three major state highway contracts on which the contractor was unable to meet his required time schedule. The three projects in El Dorado, Placer and Shasta Counties, totaling an estimated 10 million plus dollars, had all been originally awarded to Norman I. Fadel Construction Company of Marysville.

State Public Works Director John Erreca said he was well pleased with the work done both by the contractors and the Division of Highways personnel in correcting the situation. "Both groups cooperated very well and almost no time was lost in transferring the contracts to new bidders," he said in a letter to State Highway Engineer J. C. Womack.

Because there had been no similar situations in the past 15 years, Division of Highways employees were required to virtually blaze a new trail to expedite letting new bids and get work resumed in the minimum time allowed by law. One time factor was in their favor—the law requires a contractor must be notified five days in advance before he loses a contract for cause.

During these five-day grace periods division engineers spent many extra hours figuring out each item contained in the original contract that had been completed, partially completed, untouched. Then cost factors had to be derived for each item, and finally the overall amount of cash required to finish the project.

Although six weeks usually is required by the state just to advertise a contract, open resultant bids, and make award, in each instance the procedure was cut down to about 10 days. The division normally throws out all bids and starts over if the low bid on any project is 10 percent above the amount considered fair.

In addition, on most contracts, the Federal Bureau of Public Roads must concur on the amount of the contract because federal funds are so often involved. There was some concern within the division as to whether the responding contractors might bid too high because of the limited time allowed them for their calculations.

The bidders had their problems too, but they overcame them. They normally have a one-month minimum in which to figure a contract before submitting a bid but this time they had to complete their calculations in about one-third the usual time.

They responded by assigning their best engineers to the task and staffs worked overtime at home offices in refining physical facts into dollar estimates.

Four firms submitted bids to complete five miles of Interstate 5 near Anderson in Shasta County where approximately 20 percent of the work remained unfinished. Fredrickson and Watson was low at $1,121,894.86. The company was awarded a contract on the same day bids were opened, September 13, and had men and equipment on the job the same day.

They worked a slipform paver around the clock for 336 consecutive hours and by October 10 were well ahead of schedule. Although some finishing touches may be required next spring, the bulk of the work has been done and the freeway will be open to traffic throughout the winter.

Other bidders were Ray Kizer Construction and R. A. Heintz Construction Company (joint venture); Gibbons and Reed Company and Hughes and Ladd (joint venture).

The El Dorado project was a 2.2-mile stretch of US 50 near Bass Lake that was about 65 percent complete. Its original value was $1,571,000.

Granite Construction Company's offer of $727,735.30 was low among six bidders, and work was resumed the day after bids were opened. The job probably will shut down during the bad weather sure to come with the winter, but the new firm will have two lanes of new road paved and open to traffic by that time.

Other bidders were Huntington Brothers; A. Teichert and Son, Inc.; Merrill L. Dubach; American Paving Company and Thomas Construction (joint venture); and Harms Brothers.

Granite Construction Company was the successful bidder, $3,218,706, on the Nevada County job, where 3.4 miles of Route 20 was under construction in Nevada City. The original contract, $5,416,296.22, was about half complete, and the community was disturbed because some overcrossings had not been built and local traffic was handicapped in moving about the city.

For that reason the new contract awarded Granite stipulated the Broad Street overcrossing be completed within 35 working days. The new firm was moving heavy equipment toward the site the same day it was awarded the bid, and a full crew was working on the overpass within three days.

Other bidders were Fredrickson and Watson; Harms Brothers, Gordon Bal Enterprises, Homer J. Olsen, and Huntington Brothers (joint venture) and Parker, Baun and Thomas.

J. C. Womack, State Highway Engineer, congratulated those unknown individuals among the contractors forces who did such fine work. He also said that although many of the Division of Highways employees could have done as well, he wanted to commend the following members of his own staff who worked on the projects. Included (at the division's Sacramento Headquarters), are Bruce Gentry, construction field representative; M. W. Beckstead, Charles Nassi Clarence Nevis, specifications; Clarence Peterson, plans and estimates R. R. Norton, office engineers; David Swansen and Stanley Newell, bridge department.

In Redding (District 02 headquarters): H. S. Miles, district engineer Walter Nett, assistant district engineer; George Bischof, resident engineer; H. C. Holum, reports engineer and E. C. Engle, construction engineer.

In Marysville (District 03 headquarters): Willard Warren, district engineer; Ed Miller, assistant district engineer; Art Nelson, Barney Hutsinpiler Ralph Sandler, resident engineer; G H. Brummond, Richard Peacemaker reports engineers.

NEW USE OF SPACE

By Howard Smith

Sunnyvale's former Greyhound bus station, housed in a mobilehome, lacked restroom facilities and adequate parking.

New passenger waiting and freight and luggage storage facilities located beneath Mathilda Avenue overhead.

Proof that the space beneath a freeway structure can be used for other purposes is evinced in the new Public Accommodations Building in Sunnyvale. Located under the Mathilda Avenue Overhead on Route 85, the building provides public service as well as earns its cost through lease of a portion of the building to the Greyhound Bus Company.

In a dedication speech when the building was opened for use, Mayor Eugene Conrady said:

"Today we gather to celebrate the opening and dedication of what we believe is a unique public building . . . We believe it is the first project in California that takes this kind of double advantage of . . . areas in our business districts . . . To our knowledge, it is the first use of the airspace *under* a structure required for the efficient movement of automobiles," said Mayor Conrady.

It all came about this way. Back in 1958, the City of Sunnyvale started an urban renewal plan to clear a blighted area of family dwelling units and poor commercial buildings, one of which was the Greyhound Bus Depot. Although many months were spent in a search for a new site, every suitable location was either too expensive or not available.

In desperation, the Greyhound Company rented a large trailer for use as an interim station and placed it on an undersized, unpaved parking lot just outside the downtown business district. The waiting room consisted of two outdoor benches, and the baggage and freight were stacked in the open.

In the meantime, the City of Sunnyvale was building an overhead structure on Mathilda Avenue (Route 85) to carry traffic over the railroad tracks. Funds were provided by the city, state, and Southern Pacific Company for this project, which was opened to traffic on May 10, 1965.

One day, while the overhead structure was under construction, City Manager Thomas H. Sweeney spotted the unused land under the overhead.

"Why not put the bus station there?" he thought.

It was near acres of parking, it was only a short block away from the center of the business district, and it offered ready access to the routes traveled by the bus line. In addition, the property had already been bought and paid for.

Mr. Sweeney, with the services of Architect Byron Lundburg, proposed that the city erect a bright, cheerful building on this rather small, dark site. It would be leased to the Greyhound Bus Company and could also become a center for a number of public purposes. It provides needed restrooms in the downtown area. The building might well be the focal point of a local transportation system in the future.

Best of all, as far as the taxpayers are concerned, Greyhound's monthly rental of the building would completely pay off the $55,000 cost of construction in a number of years.

Currently being installed is a landscaped outdoor patio to provide a parklike area for relaxation.

Since the location of Route 85 along Mathilda Avenue was to be switched a mile to the west along the new "Stevens Creek Freeway," and the area was to be relinquished to the city, an encroachment permit was issued on January 20, 1965, to allow the City of Sunnyvale to build the facility.

Bylines

WHAT'S UP—IN THE AIR? Eric P. Grant (3) was born in Los Angeles, received his law degree from Southwestern University and is now a member of the State Bar. He worked 5½ years in the enforcement division of the Los Angeles County Air Pollution Control District. He was appointed assistant executive officer of the Motor Vehicle Pollution Control Board in 1961 and became its executive officer in April of this year.

JOHNNY LUPINESEED Marcia J. Mickelsen (4) is a native Nebraskan and a gradnate of the University of Nebraska who began her career in medical public relations in Omaha. She served on the staff of the *Medical World News* before coming to California in 1961 to become director of public relations of a San Francisco medical center. She joined the Division of Highways as an assistant information officer in 1963.

FROM THE DESK OF R. J. DATEL Robert J. Datel (5) is the youngest district engineer in the Division of Highways. He was appointed to his present post in San Luis Obispo in 1963 when he was 38 years old. A native of Wessington, South Dakota, he received his civil engineering degree from the University of Minnesota and joined the division in 1948. The present article was originally prepared by Datel for the employees in his own district and appeared in the District 5 house organ.

AN ENGINEER LOOKS AT AESTHETICS Louis G. Kroeck (1), who was awarded the 1965 *Parade* magazine national award for the design of the most beautiful highway, is a native of San Jose and a graduate of the University of the Pacific. He came to work for the Division of Highways Stockton office in 1946. Now traffic engineer for the district, Kroeck spent much of his career in design work and was district design engineer at the time he won the *Parade* award. Among his hobbies he includes hiking and camping, watercolors, photography, woodworking, hi-fi, and gardening.

Louis O. Baker (2), who illustrated the article, is an architectural assistant with the Division of Highways Bridge Department in Sacramento and has sold many watercolor paintings. A native Sacramentan, he also attended school there and began his state career with the Division of Forestry in 1948. He worked for the Department of Water Resources before joining highways in 1957.

NEW USE OF SPACE Howard M. Smith (6) is an assistant information officer for the Division of Highways in San Francisco. He was born in Chicago and was an honor graduate in journalism from the University of California at Berkeley. Smith was editor of several U.S. Navy publications and was twice recipient of an armed forces press service award. He was assistant editor for *Western Construction* magazine from 1953 to 1954. He joined state service in 1961.

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STATE OF CALIFORNIA

EDMUND G. BROWN, *Governor*

TRANSPORTATION AGENCY

ROBERT B. BRADFORD . . . Administrator

DEPARTMENT OF PUBLIC WORKS . . . JOHN ERRECA, Director

FRANK A. CHAMBERS . . . . Chief Deputy Director

RUSSELL J. COONEY . . Deputy Director (Management)
HARRY D. FREEMAN . . Deputy Director (Planning)
T. F. BAGSHAW . . . . . Assistant Director
C. RAY VARLEY . . . . . Assistant Director
JUSTIN DuCRAY . Departmental Management Analyst
S. ALAN WHITE . . Departmental Personnel Officer

DIVISION OF HIGHWAYS

J. C. WOMACK . . . State Highway Engineer, Chief of Division

J. P. MURPHY . . . Deputy State Highway Engineer
J. A. LEGARRA . . Deputy State Highway Engineer
GEO. LANGSNER . . Deputy State Highway Engineer
LYMAN R. GILLIS . Assistant State Highway Engineer
J. E. McMAHON . . Assistant State Highway Engineer
FRANK E. BAXTER . Assistant State Highway Engineer
GEORGE A. HILL . Assistant State Highway Engineer
J. C. BURRILL . . . . . Comptroller
NEAL E. ANDERSEN . . . . . Equipment Engineer
JOHN L. BEATON . . Materials and Research Engineer
C. G. BEER . . . . . Urban Planner
A. N. DUNHAM . . . Computer Systems Engineer
ALVORD C. ESTEP . . . . . Engineer of Design
J. F. JORGENSEN . . . . . Construction Engineer
SCOTT H. LATHROP . Personnel and Public Information
C. T. LEDDEN . . City and County Projects Engineer
JACK E. PEDDY . . . . Project Control Engineer
DANA G. PENGILLY . . . . . Planning Engineer
E. J. L. PETERSON . . Program and Budget Engineer
R. V. POTTER . . . . Systems Research Engineer
PAUL C. SHERIDAN . . . . . Office Engineer
E. L. TINNEY . . . . . Maintenance Engineer
DONALD P. VAN RIPER . Principal Landscape Architect
J. E. WILSON . . . . . Traffic Engineer
A. L. ELLIOTT . . . . Bridge Engineer—Planning
H. R. HINEMAN . . . Bridge Engineer—Operations
R. J. IVY . . . Bridge Engineer—Administration
DALE DOWNING . . Bridge Engineer—Southern Area

Right of Way

RUDOLF HESS . . . . . Chief Right of Way Agent
HARRY L. KAGAN . . . . . Assistant Chief
DEXTER D. MacBRIDE . . . . . Assistant Chief
R. S. J. PIANEZZI . . . . . Assistant Chief

District 1, Eureka

SAM HELWER . . . . . District Engineer

District 2, Redding

H. S. MILES . . . . . District Engineer

District 3, Marysville

W. L. WARREN . . . . . District Engineer

District 4, San Francisco

ALAN S. HART . . . . . District Engineer
R. A. HAYLER . . . . . Deputy District Engineer
HAIG AYANIAN . . . . . Deputy District Engineer
C. F. GREENE . . . . . Deputy District Engineer

District 5, San Luis Obispo

R. J. DATEL . . . . . District Engineer

District 6, Fresno

R. E. DEFFEBACH . . . . . District Engineer

District 7, Los Angeles

E. T. TELFORD . . . . . District Engineer
A. L. HIMELHOCH . . . . Deputy District Engineer
A. C. BIRNIE . . . . . Deputy District Engineer
A. W. HOY . . . . . Deputy District Engineer
T. G. LAMMERS . . . . . Deputy District Engineer

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ABRAHAM KOFMAN . . Vice Chairman Alameda
ROGER S. WOOLLEY . . . . San Diego
WILLIAM S. WHITEHURST . . . Fresno
JOSEPH C. HOUGHTELING . . Sunnyvale
ALEXANDER H. POPE . . . Los Angeles

JOHN ERRECA . Administrative Officer and Director of Public Works
JACK COOPER, Secretary . . . Sacramento

District 8, San Bernardino

C. V. KANE . . . . . District Engineer

District 9, Bishop

C. A. SHERVINGTON . . . . . District Engineer

District 10, Stockton

JOHN G. MEYER . . . . . District Engineer

District 11, San Diego

JACOB DEKEMA . . . . . District Engineer

DIVISION OF CONTRACTS AND RIGHTS OF WAY

HARRY S. FENTON . . . . . Chief Counsel

EMERSON RHYNER . . . Deputy Chief (Sacramento)
HOLLOWAY JONES . . . Deputy Chief (San Francisco)
REGINALD B. PEGRAM Deputy Chief (Los Angeles)

DIVISION OF BAY TOLL CROSSINGS

E. R. FOLEY . . . . . Chief Engineer, Chief of Division

J. J. KOZAK . . . . . Deputy Chief Engineer
THOMAS G. BERTKEN . . . . . Planning Engineer
BEN BALALA . . . . . Construction Engineer
VERNON J. RICHEY . . . . . Design Engineer
CHARLES L. SWEET . . . . . Operations Engineer
GEORGE F. ANDERSON . . . Administrative Officer

DIVISION OF AERONAUTICS

CLYDE P. BARNETT . . . . . Director, Chief of Division

(October 3, 1966)

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CALIFORNIA highways and public works

NOVEMBER DECEMBER 1966

annual report issue

Letters of Transmittal

December 19, 1966

MR. JOHN ERRECA
Director of Public Works
State of California

Dear Sir:

I am submitting herewith for your approval and transmittal to the Governor, the 20th Annual Report of the Division of Highways for the fiscal year ending June 30, 1966. The report was prepared in compliance with Section 143 of the Streets and Highways Code.

As before, the text portion of the report with accompanying illustrations is being published as the November–December issue of *California Highways and Public Works* magazine. Detailed financial statements, tables and contract statistics will appear in a supplement which will be available to anyone on request.

Although a large portion of the past fiscal year's highway program continued to be devoted to completion of the interstate system, significant progress was also made in implementing the state's Freeway and Expressway Act of 1959. Of the 12,500 route miles decreed by the Legislature, 7,323 (59 percent) now have been adopted by the California Highway Commission and 4,240 (34 percent) have been built or are under construction.

Following completion of a comprehensive inventory of accident concentration locations on the entire state highway system, plans are now going ahead to correct 1,700 locations at a cost of $30,000,000 plus an additional $6,500,000 in cooperation with local jurisdictions. Target completion date is September 1, 1969. It is estimated that there will be 4,800 fewer accidents per year when all projects are completed.

Respectfully,

J. C. WOMACK
State Highway Engineer

December 20, 1966

EDMUND G. BROWN
Governor of California

My Dear Governor:

I am pleased to submit to you the 20th Annual Report of the Division of Highways.

Done in a shorter, more popularized form, this year's report, I believe, still presents the highlights of how the nation's most populous state is meeting and overcoming the challenge of an ever increasing traffic demand by moving ahead in the construction of what is undoubtedly the world's finest highway and freeway system.

Totaling some 14,215 miles at the end of the fiscal year, the state highway system included 1,945 miles of freeways. Though comprising only 2 percent of the state's paved driving surfaces, these freeways carry a quarter of the state's traffic load and have proved three times as safe to drive upon as conventional highways.

Significant progress was also made in completing our share (2,165 miles) of the federal interstate system. Approximately $1,602,365,000 has been spent, in completing 922 miles and in putting under construction or budgeting another 512 miles. Most of this mileage is in highly urbanized areas where right-of-way and construction costs are high. The bulk of the system remaining to be built is in rural areas where construction normally presents fewer problems and proceeds much more rapidly at much less cost.

Excellent progress also was made in the state's safety roadside rest program with 31 completed, 12 under construction and 89 more programmed.

More and more emphasis is being placed on the "complete" highway, a total package of function, safety and aesthetics. The division initiated a comprehensive educational program for its personnel to reemphasize the importance of aesthetics in the location and design of highways.

Respectfully,

JOHN ERRECA
Director of Public Works

CALIFORNIA
highways
and public works

VOLUME 45 NOVEMBER–DECEMBER 1966 NOS. 11–12

CALENDAR OF MEETINGS 2

CALIFORNIA HIGHWAYS–1966 3

OPERATIONS 7

CONSTRUCTION PROGRESS 10

PLANNING 13

DESIGN 20

BRIDGES—THE NEW LOOK 24

ADMINISTRATION 28

LEGAL 30

RIGHT OF WAY 31

FISCAL MANAGEMENT 32

BUDGET 34

john c. robinson, *Editor*

stewart mitchell, *Managing Editor*

william r. chaney, *Chief Photographer*

Editors are invited to use information contained herein and to request prints of any black and white photographs.

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BOB NANCE, INFORMATION OFFICER
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P.O. BOX 1499
SACRAMENTO, CALIFORNIA 95807

Cover design by Bill Metzel.
Color layouts by Chock Jong.

Robert B. Brodford

Roger S. Woolley

Alexander H. Pope

Franklin S. Payne

James A. Guthrie
Died August 23, 1966

Joseph C. Houghteling

Abraham Kolmon

William S. Whitehurst

The California Highway Commission has six members, appointed by the Governor for a four-year term without pay. The Transportation Agency Administrator is ex officio member and chairman. The commission meets each month to allocate highway funds and hold public hearings. During the year Franklin S. Payne resigned, and the Governor appointed Alexander H. Pope as his replacement.

CALENDAR OF MEETINGS

California Highway Commission

JULY 1, 1965, TO JUNE 30, 1966

July 15, 1965 — Newport Beach
Aerial and ground inspection of future freeway locations in Orange County.

July 21 — Sacramento

July 22, 23 — Bijou
Inspection of State highway needs in Sacramento and El Dorado counties and a meeting with State of Nevada Highway Board concerning highway problems in the Lake Tahoe area.

August 13 — Los Angeles
Public hearing on the location of the Route 42 (Century) Freeway between Sepulveda Boulevard and Central Avenue.

August 18, 19 — San Francisco

August 20 — Redding
Inspection of State highways in Shasta County.

September 16 — Beverly Hills
Public hearing on the location of the Route 2 (Beverly Hills) Freeway between the Interstate 405 (San Diego) Freeway and Ardmore Avenue in Los Angeles.

September 22, 23 — Sacramento

September 24 — Santa Rosa
Meeting with legislators and representatives of the Redwood Empire Association re State highway needs in the northern coastal counties.

October 20, 21 — San Diego
Regular monthly business meeting including adoption of the State Highway Budget for the 1966–67 fiscal year.

November 3 — Los Angeles
Meeting with Governor Edmund G. Brown re state highway program and problems.

November 4 — Los Angeles
Meeting with Board of Directors of the Southern California Rapid Transit District re cooperation in coordinating development of the rapid transit system with the freeway system.

November 17 — Sacramento

December 15 — Sacramento

January 19, 1966 — Sacramento

February 16 — Sacramento

March 11 — Portland, Oregon
Meeting with State Highway Commissions of Oregon and Washington re problems of mutual interest, including relationships of highways and State parks, and the financing of interstate freeways and other highways.

March 15 — Sacramento
Meeting with legislators, local officials and members of the Greater Eureka Chamber of Commerce re highway progress in Humboldt County.

March 16 — Sacramento

March 24 — Upland
Meeting with legislators, local officials and members of the Foothill Freeway Association re freeway development.

April 20 — San Jose
Meeting with the board of supervisors and technical staff re the county's expressway program, followed by a helicopter inspection of these expressways and state highways in Santa Clara County.

April 21 — Sacramento

April 22 — Bishop
Public hearing on the location of the US 395 Freeway between 1.7 miles south of Warm Springs Road and the Mono county line, and on the location of the Route 6 Freeway between US 395 and 0.3 mile north of Dixon Lane.

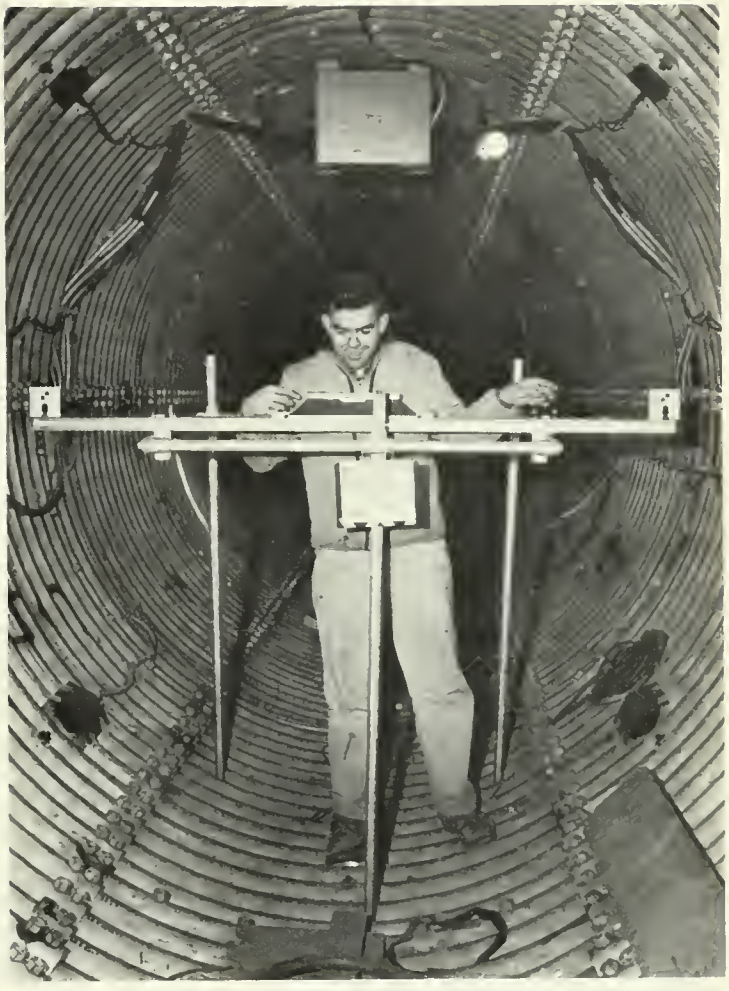
May 18, 19 — Los Angeles

June 8 — Woodland Hills
Public hearing on the location of the Route 64 (Malibu-Whitnall) Freeway in its entirety between Route 1 near Malibu Beach and the Interstate 5 (Golden State) Freeway in San Fernando Valley.

June 22 — Sacramento

June 23 — Los Banos
Highway inspection and dedication of a section of the Interstate 5 (Westside) Freeway west of Los Banos.

California Highways 1966



Setting up a reference length bar for photographically measuring culvert distortion under 167-foot-high fill at Apple Canyon, Los Angeles County.

At the close of the fiscal year (June 30, 1966) 14,215 miles of California state highways were in operation. This complex was augmented by 150,034 miles of city streets, county roads and miscellaneous thoroughfares.

They were in constant use by the 11,333,337 automobiles, trucks and buses licensed with the California Department of Motor Vehicles, and at peak times an additional 3,000,000 vehicles registered in other states joined the traffic flow.

They traveled more than 90,000,000,000 vehicle-miles—a daily average equal to 500 round trips to the moon. Of this amount, one-fourth was carried by the world's busiest network of its kind, the 1,945 miles of freeways incorporated into the state highway system. Yet these very busy miles made up less than 2 percent of the state's paved driving surfaces.

The remainder of the state highway system accounted for another quarter of the miles driven, thus relieving city streets, county roads and similar nonstate thoroughfares of 50 percent of the traffic.

Freeway System

This performance by the freeway system shows that progress is being made in fulfilling the intents of the Freeway and Expressway Act of 1959. When signed into law, the act was designed to connect all county seats and major population centers with modern traffic carriers, and it was assumed that the system could not be completed prior to 1980. At that future time, it will constitute approximately 10 percent of the paved highways, roads and streets in California but will carry 60 percent of the traffic.

Progress made to date toward this goal can be measured by the miles of route adopted by the California Highway Commission and the miles built or under construction by the Division of Highways. Of the entire 12,500 route miles decreed by the Legislature, 7,323 (59 percent) have been adopted by the commission and 4,240 (35 percent) have been built or are under construction by the division.

The system has 10,400 rural miles, and 2,100 urban miles.

A review of the history of freeway construction in California reveals its constantly accelerating rate.

Following construction of the state's first freeway (the Arroyo Seco, now Pasadena, Freeway in Los Angeles) in 1939, completed multilane freeway mileage had only increased to 22 by the end of World War II. However, by 1950 it had jumped to 229; by 1956, when construction on the federal interstate system was started, the state total had grown to 673. The present total now stands at 2,622, with another 688 miles under construction or budgeted.

Interstate

The highway construction program in each of the 50 states is strongly influenced by the federal government's national system of interstate and defense highways. This network, which upon completion is expected to carry more than 20 percent of all vehicle traffic in the United States, was well on its way to completion at the close of the fiscal year. Over 21,500 miles of the ultimate 41,000-mile network were open to traffic and construction was under way on an additional 6,310 miles.

The interstate is designed to handle traffic needs anticipated for 20 years from now, and the entire system is scheduled for completion by 1974. It's construction was authorized by Congress under the Federal Aid Highway Act of 1956. Approximately 90 percent of the funds it requires are derived from federal excise taxes that are levied on highway users. The remainder is provided by the state on all construction that takes place within its geographic boundaries.

In California, approximately $1,602,365,000 has been spent, obligated or budgeted to date to pay for interstate construction. The state's share of the total interstate system is 2,165 miles. Of that amount, 922 miles are complete, 512 under construction or budgeted for construction, and routes for the remainder have been adopted. Although it appears that California is slightly behind schedule in completing its share of the interstate, the opposite is true; for the bulk of that which remains to be built is in rural areas where construction normally presents fewer problems and proceeds much more quickly than in urban locations, where the Division of Highways concentrated its initial efforts.

STATUS OF THE FEDERAL HIGHWAY TRUST FUND

(Thousands of Dollars)

	THREE MONTHS ENDED JUNE 30, 1966	FISCAL YEAR 7/1/65 TO 6/30/66
Balance at beginning of period	87,796	284,858
INCOME:		
Tax revenue:		
Motor-fuel taxes (net after refunds)	723,130	2,874,237
Less motor-boat fuel revenue [1]	2,600	28,000
Net for highways	720,530	2,846,237
Trucks, buses, and trailers	111,564	441,969
Tires, tubes and tread rubber	134,617	496,614
Vehicle use	16,705	101,983
Parts and accessories, trucks and buses	5,000	7,000
Lubricating oil (net after refunds)	17,500	23,000
TOTAL EXCISE REVENUES	1,005,916	3,916,803
Interest earned	2,494	7,983
Advances from General Fund	–	70,000
Less repayment of advances	–	70,000
TOTAL INCOME	1,008,410	3,924,786
DISBURSEMENTS:		
For highways	853,511	3,966,271
Interest on advances from General Fund	–	678
TOTAL DISBURSEMENTS	853,511	3,966,949
Balance at end of period	242,695	242,695

[1] Transferred to the Land and Water Conservation Fund pursuant to Title II, Sec. 202, Public Law 88-578, effective January 1, 1965.

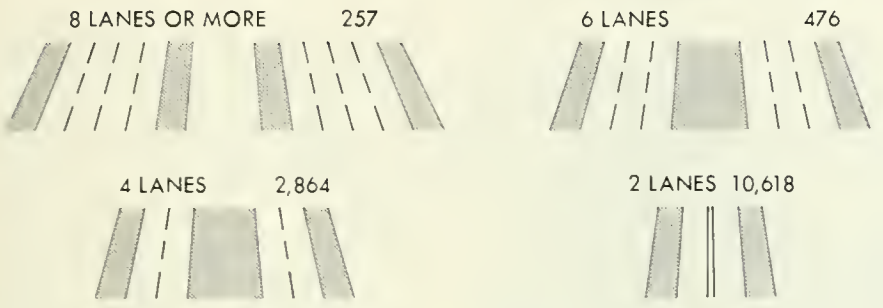
SOURCES OF STATE HIGHWAY REVENUE 1966-1967

MOTOR VEHICLE FUEL TAX	397,498,000
MOTOR VEHICLE REGISTR. FEES	99,753,000
USE FUEL TAX	31,100,000
TRANSPORTATION TAX	15,700,000
INTEREST ON INVESTMENTS	3,000,000
INTEREST ON CONDEMNATION DEP.	1,000,000
FEDERAL AID	347,922,680
OUTDOOR ADVERTISING	142,000
TOTAL	$896,115,680

BREAKDOWNS ON MILEAGE IN OPERATION

JUNE 30, 1966

MILEAGE BY NUMBER OF LANES



TOTAL MILEAGE 14,215

BREAKDOWNS ON MILEAGE IN OPERATION

JUNE 30, 1966

MILEAGE BY TYPES OF SURFACE

ASPHALT SURFACE	7" OR MORE BASE & SURFACE	9,061
ASPHALT SURFACE	LESS THAN 7" BASE & SURFACE	2,294
CONCRETE		1,842
OILED EARTH		987
UNPAVED		31
	TOTAL	14,215

Overall supervision of interstate construction at the national level is vested in the Department of Commerce, which in turn has placed primary responsibility in the Federal Bureau of Public Roads. In California, the Department of Public Works and the Division of Highways serve in like capacities at State level.

Safety Roadside Rests

Considerable progress was made in the safety roadside rest program, and at the end of the fiscal year 31 were open to the public. Included in this group were 11, previously under the jurisdiction of the Division of Beaches and Parks, that were scheduled for renovation. An additional 12 were under construction and 89 others programmed for construction.

A substantial number of those in the programming stage will be located along interstate routes in pairs to accommodate traffic from both directions. Among the facilities they will offer are parking spaces for 20 to 35 automobiles, plus 8 to 14 trucks and truck-trailer combinations. Restrooms, drinking fountains, picnic tables, paved walkways and lighting are featured in design plans.

Scenic Highways

The state scenic highway system, comprising over 6,000 miles of state highway, was established by the Legislature in 1963. The goal of this program is the protection and conservation of scenic corridors through local control of land use along the scenic route. Workshop sessions have been held in all districts to assist local agencies to complete the qualifications needed for official designation of a highway as a scenic highway.

These procedures pertain principally to the area beyond the right-of-way. The division has also instituted sound aesthetic practices to be employed within the right-of-way of all highways, including scenic highways.

Additional emphasis has been placed on the "complete" highway which is a total package of function, safety and aesthetics. In line with the approach, the division initiated a comprehensive educational program to reemphasize the importance of aesthetics in the location and design of highways. Training sessions and seminars were held throughout the state as a part of this educational program.

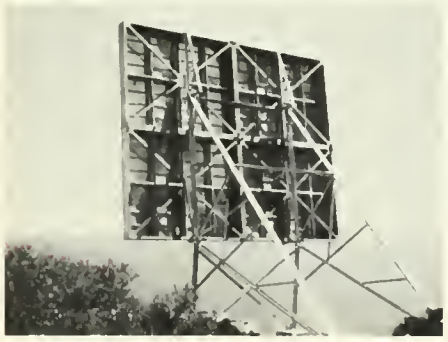
The Aesthetic Committee is composed of the Principal Landscape Architect, Engineer of Design, and Bridge Planning Engineer. Weekly meetings of this committee have acted as a forum in which new design ideas are brought out, and established techniques are reexamined. Counterparts of the Aesthetics Committee have been established in each district to perform a similar function at the district level.

Aesthetic reviews in the field, which were initially conducted only on scenic highways, are now being conducted on all highways. Alternate routes are reviewed before adoption and two further reviews are made as the design work progresses.

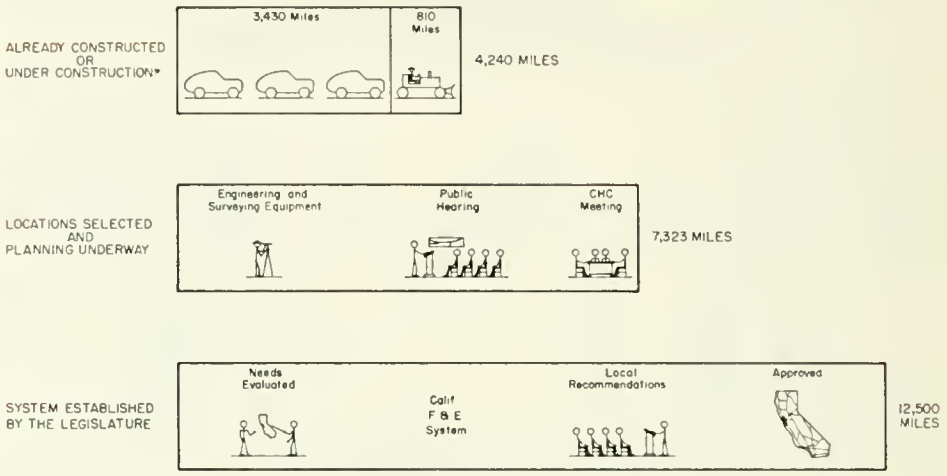
Administration

The Division of Highways is administered by the State Highway Engineer, whose position is included in the civil service system. In addition to the State Highway Engineer's headquarters staff, there are 11 district highway engineers who under the direction of the State Highway Engineer, administer the 11 highway districts into which the state is divided. (For detailed information on the Division of Highways organization, see the official roster inside the back cover.)

RICHOCHETING RADIO SIGNALS — Like Chinese demons, FM radio signals can only travel in straight lines. So, in order to bounce them down to the new Kyburz maintenance station on Highway 50 at the bottom of the rugged South Fork of the American River Canyon, the Division of Highways had to build a passive repeater on the top of Alder Ridge in El Dorado County. All equipment and construction materials, including cement, were flown in by helicopter. In photo above a helicopter lowers a section of the 16-by-20-foot repeater panel on to the ridge. Photo below shows the assembled repeater. Kyburz is located out of sight down in the canyon beyond.



STATUS OF FREEWAY AND EXPRESSWAY DEVELOPMENT (MILEAGE)
JUNE 30, 1966



*INCLUDES TWO-LANE EXPRESSWAYS THAT MAY LATER BE CONVERTED TO MULTILANE EXPRESSWAYS OR FREEWAYS

DIVISION OF HIGHWAYS EMPLOYEES

PROFESSIONAL ENGINEERING	3,746
ENGINEERING TECHNICIANS	4,604
MAINTENANCE	4,499
CLERICAL ADMINISTRATIVE ACCOUNTING, ALL OTHER	5,008

INTERSTATE

U.S.

TOTAL U S INTERSTATE MILEAGE	41,000
TOTAL COMPLETED U S INTERSTATE	21,000
OPEN TO TRAFFIC	53%
FULL OR ACCEPTABLE STANDARD	39%

CALIFORNIA

TOTAL CALIFORNIA INTERSTATE AS OF JUNE 30, 1966	2,165
TOTAL COMPLETED CALIFORNIA INTERSTATE AS OF JUNE 30,1966	922
CALIFORNIA INTERSTATE FUNDS EXPENDED OR BUDGETED	1,602,365,000

ALL CALIFORNIA INTERSTATE MILEAGE ALREADY ADOPTED

Although California is slightly behind the national average in completion of its interstate routes, it is because most of the state's interstate funds have been spent on the more expensive urban freeways to solve urgent traffic problems.

•Operations

CONSTRUCTION

Currently, the highway construction program includes about 320 active contracts totaling more than $600,000,000. A major portion of this amount is devoted to interstate and defense highway projects in order to complete the system in accordance with the federal deadline in the early 1970's.

By districts, the current construction funds are allocated as follows:

District 1	$26,321,000
2	30,298,000
3	53,758,000
4	108,586,000
5	33,265,000
6	40,194,000
7	171,023,000
8	24,501,000
9	4,029,000
10	33,526,000
11	82,651,000
	$608,152,000

Contractor's crew shown above is completing the asphalt shoulders on a new freeway, only one of the many lesser tasks necessary before a new section can be opened.

MAINTENANCE

At the end of the 1966 fiscal year, the Division of Highways employed about 4,500 maintenance personnel working out of 317 maintenance stations to care for 14,215 miles of state highways. Total expenditure for maintenance during the year exceeded $56,390,000.

The above figures include personnel and costs to maintain and improve the landscaping on the state highway system. This included the maintenance of an increasing number of roadside rest areas throughout the state, which by the end of the reporting period totalled close to 30. (See page 14.)

Right: A cutter, similar to a lawn edger in purpose, has been developed by the State Division of Highways to trim vegetation from the curbing alongside highways. The machine can clear from three to five miles of roadside per hour, compared with one mile a day accomplished by a man on foot.

MATERIALS AND RESEARCH

The Materials and Research Department serves the highway building program in several ways: It tests materials to determine their potential quality, and manufactured articles to determine their compliance with specifications; provides inspection service at fabrication shops and manufacturing plants to insure the soundness of structural members and other manufactured items supplied for bridge and highway use; develops and maintains testing standards; investigates new materials, products and methods to determine their worth for highway use; initiates and performs research on testing methods and uses of materials; develops new methods of evaluating materials or quality of work; cooperates with other departments in providing technical services for research projects; supervises the record sampling and testing program; and trains certain division personnel in the use and testing of materials.

Much of the department's work is done in collaboration with other headquarters units or with the districts. The laboratories in the various districts perform some 35 different preliminary and construction control tests on soils, aggregates and paving materials, providing immediate control of materials as they enter the work and reduce time lags and costs associated with transporting test samples from remote locations, as well as insure that only quality material enters the work.

Since its start in 1912 in a small frame building, the Materials and Research Department has grown to a stature commanding respect among highway engineers all over the world. Each year hundreds of visitors come to the "Lab" from all over the U.S. and other parts of the world, to spend a few hours or a few days there. In 1966 there were 56 visitors from 24 foreign countries, of which 49 were engineers, 4 were university professors, and 3 were engineering students.

Above: Materials and research engineers show a visiting German delegation a box beam median barrier on field test location. Below: Commercial instrument for measuring the supporting strength of roads for traffic loads.

Scope of Work

In each of the various sections, an almost innumerable number of tests are made every year to determine quality of materials, as well as quality of workmanship, on many sections of highway. The Foundation Section alone made thousands of such routine tests as permeability, compressibility, and consolidation of soils. Hundreds of other tests ranged from projects on high fill study, to deep bores to determine the suitability of subterranean materials to bear a highway. All of the information collected by this unit contributes greatly to the smooth riding qualities of a completed highway.

In the same area of endeavor the Pavement Unit studies the makeup and quality of surfacing materials. Its tests run into the tens of thousands each year, and not only are concerned with smooth riding qualities of the roadbed, but also its ability to withstand wear.

Paving thickness varies with the type of highway. Generally it is not economical to pave as thickly on a lightly travelled two-lane highway as would be necessary on an eight lane urban freeway expected to bear heavy truck traffic. The paving requirements for the particular job are set forth in the contract, along with a multitude of other requirements which bind the contractor to a definite standard of quality.

The Concrete Section functions primarily for checking the adherence of contractors to the specifications set up in the contract. Cores are drilled from the pavement to be sure the required thickness is achieved. About

4,200 cores per year are obtained for this purpose.

As a watch dog of these requirements, the Concrete Section made tests for compressive strength on 8,300 concrete cylinders primarily from bridge jobs. Over 400 samples of sand were tested for mortar strength. Another heavy output was nearly 4,000 tests of concrete aggregate samples for sodium sulfate soundness, in other words, resistance to weathering.

The range of materials tested in the Chemistry Laboratory is staggering. One of the heaviest was 1,500 tests of zinc coatings on steels, but close runners-up were tests on paints, cements, soils, water, and thermoplastic traffic line paints. Other materials tested thoroughly were such things as epoxy adhesives, soil sterilants, porcelainized enamels on signs, joint sealants, and wood preservatives. This unit also did more than 300 tests for non-Division of Highway agencies.

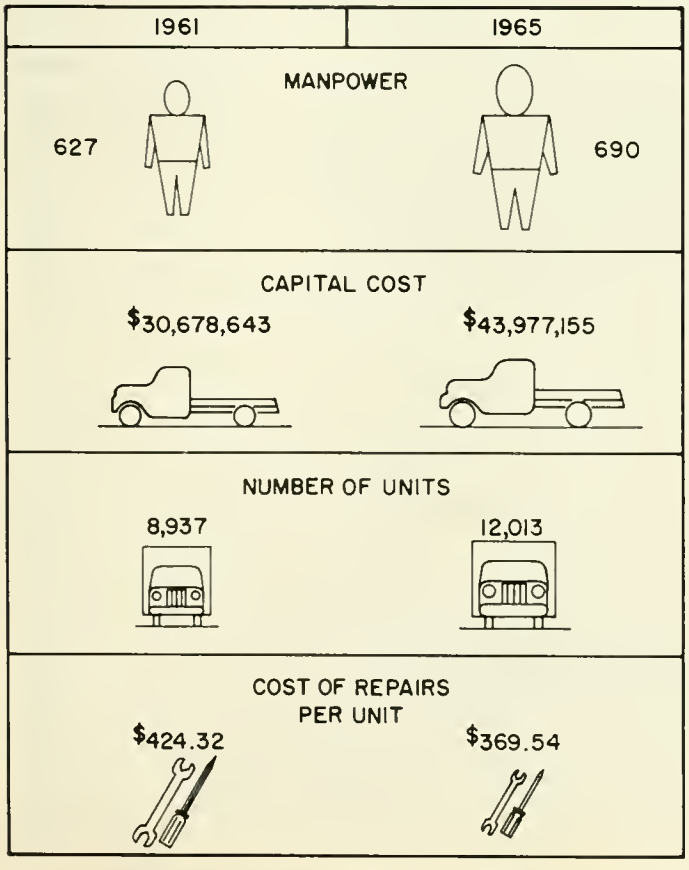
About 50,000 inspections and tests were made in the past year on commercial plants manufacturing structural materials, primarily those more commonly used ones such as steel, prestressed concrete, and various kinds of pipe. Also included were such things as more than million board feet of timber, both treated and untreated; more than a million lineal feet of guardrail; various kinds of electrical conduit, and over 400,000 square feet of expansion joint material.

Special research projects involved the expenditure of $1,170,300 for 132 projects. These were in the fields of highway safety, improvement of design, improvement of materials, methods of testing, basic research, and development of equipment.

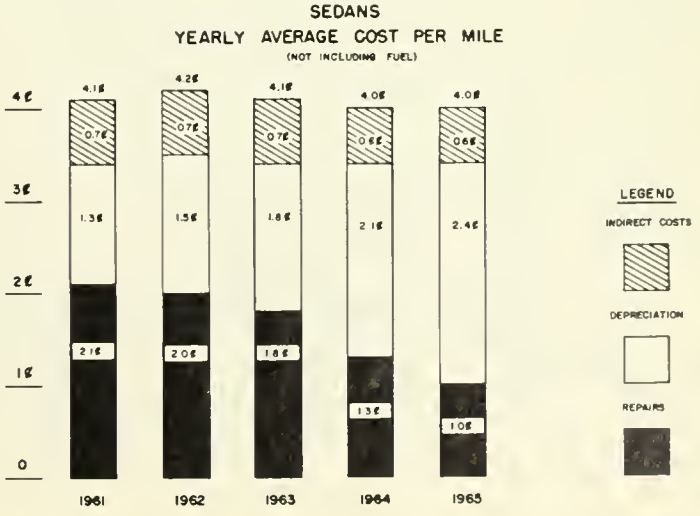
EQUIPMENT

As a service agency to the Division of Highways, the Equipment Department repairs and maintains all rental equipment used by the Division of Highways.

The Equipment Department manufactures and constructs specialized equipment utilizing skill, craftsmanship, modern materials and techniques comparable to those employed in industry. In addition, many modifications to existing units are made to increase their capabilities by using similar methods. This capability has provided considerable savings in costs and has provided various operating units of the Division of Highways equipment that meets their specific needs.



Left: Chart shows increasing efficiency of equipment shop over four years despite growing number of lane-miles of highway. Below: Continued improvement is also apparent in costs of operating sedans for official business.



•Construction Progress

This is not a listing of all construction jobs completed during the fiscal year. It includes some of the more important, some of the more costly, and some jobs that simply are typical of many others. Several counties are not mentioned, but this is not because their state highways lack importance. Future reports will list projects located within their borders for state law provides that a minimum of $4,000,000 must be spent on state highway construction in each California county within each four-year period, with the exception of Alpine and Sierra, where $3,000,000 must be spent.

Alameda	Interstate 680	Eight-lane MacArthur Freeway in Oakland between 0.25 mile west of Buell Street and the east city limit near Durant Avenue	4.6 miles	$13,110,000
	I-580	Eight-lane MacArthur Freeway between 0.3 mile east of Sybil Avenue and just east of 173rd Avenue in San Leandro	2.9	6,128,400
	I-580	Construct the First Street Interchange near Livermore and the Tassajara Road Interchange at the north city limit of Pleasanton	.....	1,504,000
	Rte. 24	Eight-lane Grove-Shafter Freeway between 0.4 mile west of the Warren Boulevard Freeway (Rte. 13) in Oakland and the Caldecott Tunnel in Berkeley	1.3	4,844,600
Alameda, Contra Costa	I-580 and I-580	Six-lane freeway on I-680 between 0.4 mile south of the I-580 Freeway and one mile north of the Alameda-Contra Costa county line near Dublin, and widen one-half mile of the I-580 Freeway to eight lanes on each side of the interchange with I-680	3.1	6,843,600
Amador	Rte. 88	Two-lane expressway on the Carson Pass Highway between 2.5 miles east of Corral Flat and 2.6 miles west of the Alpine county line	8.7	1,766,400
	Rte. 124	Two-lane expressway between 2.4 miles north of Ione and Route 16	5.6	1,966,300
Butte	Rte. 99	Four-lane freeway between 0.6 mile south of Centerville Road and Sierra Vista Way, in and near Chico	8.6	2,484,600
Calaveras	Rte. 4	Widen Ebbetts Pass Highway between Ganns Meadow and 2.5 miles west of the Alpine county line	5.6	1,746,500
Colusa	Rte. 45	Realign a curve on the Colusa-Hamilton City Highway, about 1.9 miles north of Colusa	.....	29,600
Contra Costa	I-680	Revise the southbound on-ramp near Escobar Street, in and near Martinez	.....	36,500
Del Norte	US 101	Two-lane expressway on the Redwood Highway between Klamath South Bank Road and Rte. 169 in Klamath	1.1	3,476,400
	Rte. 199	Replace two flood-destroyed bridges and approaches on the Redwood Highway across the Middle Fork Smith River	1.8	1,856,100
	Rte. 199	Repair flood damage on portions of the Redwood Highway between 6.2 and 16.4 miles north of Gasquet	2.4	1,330,400
El Dorado	US 50	Four-lane freeway between 0.3 mile east of Camino and 1.1 miles east of Sly Park Road in Pollock Pines	6.6	5,029,400
Fresno	Rte. 41	Eight-lane South Fresno Viaduct Freeway between Rte. 99 and Van Ness Avenue in Fresno	0.8	3,189,300
Glenn	I-5	Four-lane freeway between one mile north of Artois and the Tehama county line	11.0	5,451,600
Humboldt	Rte. 299	Four-lane Blue Lake Freeway between 0.2 mile west of Mad River and Blue Lake	4.6	6,959,600
	US 101	Four-lane freeway on the Redwood Highway between Dean Creek and 3.4 miles south of Phillipsville	2.6	2,897,400
	US 101	Replace a flood-destroyed bridge across the Eel River and construct approaches, between 2.2 and 3.0 miles south of Scotia	.....	2,344,800
	Rte. 36	Repair storm damage between 6.8 miles east of Carlotta and 2.2 miles west of Bridgeville	2.2	1,165,700
	Rte. 96	Repair storm damage between 6.0 miles north of Willow Creek and 4.0 miles south of Weitchpec	1.8	1,151,800
	Rte. 299	Two-lane expressway between Green Point and 2.2 miles east of Redwood Creek, about 15 miles east of Blue Lake	4.1	1,050,100
	Rte. 36	Replace two flood-destroyed bridges across the Van Duzen River, between 7.8 and 16.1 miles east of Carlotta	.....	1,040,800
Humboldt, Del Norte	US 101	Four-lane freeway on the Redwood Highway between 0.9 mile south of the Humboldt-Del Norte county line and 0.2 mile north of Route 169 in Klamath	5.0	1,628,600
Imperial	Rte. 111	Four-lane expressway from Birch Street in Calexico northly to the Interstate 8 Freeway, and improve the existing highway from this point to existing Route 8	8.4	2,273,500
Inyo	Rte. 168	Pave to complete between 0.5 mile west of the Southern California Edison power plant and 3.3 miles west of Bishop	7.4	954,200
Kern	Rte. 99	Reconstruct and widen to six and eight lanes between 16 and 31 miles south of Bakersfield	16.0	2,749,500
	Rte. 58	Pave to complete four-lane freeway between 0.2 mile east of Keene and 0.8 mile west of the Tehachapi Overhead	7.9	1,706,000
Lassen	US 395	Resurface between Johnstonville and 3.9 miles north of Litchfield	15.1	131,500
Los Angeles	I-605	Eight-lane San Gabriel River Freeway between 183rd Street in Dairy Valley and 0.3 mile north of Whittier Boulevard in Whittier	9.5	27,458,500
	Rte. 60	Eight-lane Pomona Freeway between the Santa Ana Freeway (I-5) and Third Street in East Los Angeles, and between Atlantic Boulevard in Monterey Park and Markland Drive in Montebello	3.9	9,265,000
	I-10 and Rte. 1	Santa Monica Freeway as eight-lane Interstate 10 between Sawtelle Boulevard in Los Angeles and Lincoln Boulevard in Santa Monica, and as six- and four-lane Route 1 from this point to the west portal of the Santa Monica Tunnel	3.6	9,107,700
	Rte. 14	Eight-lane Antelope Valley Freeway between 0.5 mile west of Red Rover Mine Road and 0.5 mile north of Angeles Forest Highway, about 4.0 miles south of Palmdale	7.9	5,830,000
	US 101	Convert the Ventura Freeway from four-lane expressway to eight-lane freeway between 0.3 mile west of Las Virgenes Road and 0.4 mile southeast of the Chesebro Road Overcrossing in the Agoura area, just east of the Ventura county line	2.1	1,716,000
Marin	Rte. 131	Widen Tiburon Boulevard to a four-lane divided highway between Blackfield Drive and 0.7 mile west of San Rafael Avenue in Tiburon	1.4	668,200

Mendocino	US 101	Four-lane Ukiah Bypass Freeway between Robinson Creek and 0.2 mile north of North State Street near Ukiah	5.5	2,986,800
Merced	I-5	Four-lane Westside Freeway between 0.2 mile south of Rte. 32, about 6 miles west of Los Banos, and 1.8 miles south of the Stanislaus county line	8.6	5,269,300
Modoc	Rte. 299	Resurface 3.9 miles east of US 395, about 5.0 miles northeast of Alturas, and realign an additional 4.0 miles farther easterly	7.9	1,068,900
Mono	Rte. 120	Two-lane Tioga Pass Expressway between 8.6 and 10.6 miles west of Lee Vining	2.0	1,508,600
Monterey	US 101	Four-lane Salinas Bypass Freeway between 0.3 mile south of North Main Street in Salinas and 0.2 mile north of Espinosa Road	4.1	3,073,400
	Rte. 68	Construct a bridge across the Salinas River and construct a portion of an interchange at relocated Reservation Road (Federal Aid Secondary Route 559), about 3 miles south of Salinas	1.3	1,638,300
Orange	I-405	Eight-lane San Diego Freeway between Newland Street in Garden Grove and 0.6 mile east of Bolsa Chica Road in Westminster	3.7	8,917,194
	Rte. 22	Six-lane Garden Grove Freeway between Newland Street and 0.1 mile east of Harbor Boulevard in Garden Grove	3.5	8,094,000
	Rte. 22	Six-lane Garden Grove Freeway between 0.5 mile east of Bolsa Chica Road and 0.2 mile southeast of Garden Grove Boulevard near Golden West Street in Westminster	2.2	2,406,600
	I-5	Reconstruct the Katella Avenue Interchange on the Santa Ana Freeway in Anaheim		1,088,100
Placer	Rte. 49	Construct channelization and install traffic signals and highway lighting on Auburn-Grass Valley Road at Palm Avenue in Auburn		70,200
Plumas	Rte. 70	Two-lane Feather River Expressway between 1.5 miles east of Sloat Road and 1.8 miles west of its junction with Route 89 at Blairsden	4.6	1,893,500
Riverside	I-10	Four-lane freeway between 10.3 miles west and 4.5 miles east of Cottonwood Springs Road, between 13 and 28 miles east of Indio	14.8	4,823,400
	I-10	Construct an interchange and overhead at Date Palm Drive, about 4.0 miles west of Thousand Palms		1,005,300
	US 395	Six-lane freeway between the University of California at Riverside and Route 60	6.0	3,683,400
Sacramento, El Dorado	US 50	Four-lane freeway between Folsom Junction in Sacramento County and 2.2 miles east of the Sacramento county line	8.4	4,696,600
Sacramento	Rte. 99, I-80	Eight-lane freeway on Route 99 between Second Avenue and W-X Streets, continuing as the Interstate 80 Freeway between 29th and 30th streets to 0.1 mile north of A Street in Sacramento	1.3	7,312,800
	I-5	Initial two-lane Westside Expressway of future four-lane freeway between Route 99 at San Juan Road and the Sacramento River at Elkhorn, serving the future Metropolitan (Natomas) Airport.	4.8	1,369,200
San Benito	Rte. 180	Two-lane expressway between 2.0 miles south of Hollister and Tres Pinos	3.6	653,700
San Bernardino	I-15	Four-lane freeway between Cronese Valley and 2.0 miles east of Baker	17.9	6,916,900
	I-15	Convert the four-lane Barstow Expressway to six-lane freeway between Phelan Road and Palmdale Road in Victorville	7.3	2,911,100
	I-40	Four-lane freeway between one mile east of Route 31 in Barstow and 2.5 miles east of Daggett	9.8	5,329,200
	I-10	Widen the San Bernardino Freeway from four to eight lanes between 0.1 mile west of Etiwanda Avenue and 0.3 mile west of Riverside Avenue near Rialto, and construct a safety roadside rest for westbound traffic	8.6	1,420,300
	Rte. 18	Construct the Crestline Interchange with Route 138 on the Rim of the World Drive		2,207,200
	Rte. 18	Four-lane Rim of the World Drive Expressway between 5.9 miles north of San Bernardino's city limit and Panorama Point.	1.8	1,166,700
San Diego	I-8	Four-lane freeway between East Main Street in El Cajon and 4.0 miles west of Alpine	7.2	6,700,500
	US 395	Construct four-lane Escondido Freeway and grade an additional four lanes between 0.6 mile south of Pomerado-Miramar Road near the U.S. Naval Air Station, Miramar, and 1.4 miles north of Poway Road west of Poway	5.0	6,290,600
	I-5	Eight-lane freeway between 0.2 mile south of National City and 8th Street in National City	1.8	2,517,100
	I-5	Four- and eight-lane freeway viaduct connecting the Crosstown Freeway at Maple Street with the Pacific Coast Highway near Washington Street in San Diego	1.2	3,664,000
	I-5	Eight-lane freeway between 4.3 miles north of Balboa Avenue and Old Miramar Road in San Diego	1.4	2,657,500
	I-5	Pave to complete eight-lane freeway between 0.6 mile south of Carmel Valley Road in San Diego and 0.4 mile north of Via De La Valle near Del Mar	4.3	2,297,900
	I-5	Eight-lane freeway between 0.1 mile south of San Marcos Road near Encinitas and 4.4 miles south of Route 78 in Carlsbad	5.4	4,898,600
	Rte. 67	Four- and six-lane Lakeside Freeway between 1.5 miles north of Interstate 8 and 1.8 miles north of Santee	2.6	1,476,300
San Francisco	I-280	Six-lane Southern Freeway Extension as a one- and two-level viaduct between Newcomb Avenue and 0.8 mile north of Army Street	0.9	5,918,100
San Joaquin	I-580	Four-lane freeway between 3.8 miles southeast of the Alameda county line and Chrisman Road, about six miles west of Vernalis	7.5	4,159,400
San Luis Obispo, Monterey	US 101	Four-lane freeway between 0.9 mile north of San Miguel, San Luis Obispo County, and 1.6 miles north of Gate 1, Camp Roberts, Monterey County	4.8	2,746,000
San Mateo	US 101	Widen the Bayshore Freeway from six to eight lanes between Whipple Avenue in Redwood City and Broadway in Burlingame	4.7	1,248,600
Santa Barbara	US 101	Pave through Gaviota Pass between Gaviota and 0.1 mile north of Nojoqui Creek	6.6	407,100
Santa Clara	Rte. 85	Four-lane Stevens Creek Freeway between 0.1 mile south of Homestead Road in Cupertino and the Bayshore Freeway (US 101) in Mountain View	6.5	7,214,600
	US 101	Convert from expressway to freeway between 0.6 mile south of Tully Road and Coyote Creek in and near San Jose	2.6	1,404,200
Santa Cruz	Rte. 1	Reconstruct and resurface Mission Street between Green and Riggs Streets in Santa Cruz	0.5	117,300
Shasta	I-5 & Rte. 44	Grade and structures for 12.3 miles of four-lane Interstate 5 Freeway between Riverside Avenue north of Anderson and two miles north of Redding; and construct 1.9 miles of four-lane Route 44 Freeway between Market Street in Redding and Hilltop Road, east of that city	14.2	8,678,700
	I-5	Widen the Pit River Bridge and its southern approach		1,120,800
Sierra	Rte. 49	Reconstruct portions between 1.3 miles west of the North Yuba River Bridge and Salmon Creek		1,024,700
Siskiyou	I-5	Four-lane freeway between the Oregon state line and 1.5 miles southerly	1.5	2,181,800
	Rte. 96	Reconstruct portions of the Klamath River Highway and install drainage facilities between Happy Camp and Interstate 5, about 10 miles north of Yreka		1,056,400

Solano	I-80	Convert four-lane expressway to eight-lane freeway between 0.6 mile north of Route 12 in Fairfield and 0.1 mile southwest of Vacaville	7.1	6,766,300
	I-80	Six-lane freeway between 1.0 and 4.7 miles northeast of Route 606, about six miles northeast of Vacaville	3.7	2,494,400
Sonoma	US 101	Four-lane freeway on the Redwood Highway in and near Santa Rosa between 0.1 mile south of Edwards Avenue and Russell Avenue	1.1	1,264,000
Stanislaus	Rte. 99	Four- and six-lane freeway between 1.6 miles south of Ceres and 2.4 miles north of Modesto	8.3	7,738,600
Sutter	Rte. 20	Widen the Colusa Highway from two to four lanes between Harter Road and Route 99 near the west city limit of Yuba City	1.1	297,200
Tehama	I-6	Four-lane freeway between Corning Road near Corning and 0.6 mile north of Red Bluff	19.6	12,469,600
Trinity	Rte. 299	Construct truck passing lanes between 2.9 and 6.0 miles east of Douglas City	2.1	367,400
Tulare	Rte. 198	Four-lane freeway between 0.3 mile west of West Main Street in Visalia and County Road 164, and four-lane expressway from this point to 0.3 mile east of Route 69, northeast of Exeter	11.6	6,776,200
Tuolumne	Rte. 108	Two-lane Sonora Pass Expressway between Hunt's Camp and Twain Harte	3.0	1,193,600
Ventura	Rte. 126	Four-lane freeway between Wells Road and 0.7 mile east of Santa Paula	8.6	7,618,800
	US 101	Convert from expressway to freeway in Thousand Oaks between 0.4 mile west of Triunfo Road and 1.2 miles east of Moorpark Road		1,098,000

San Diego-Marina Freeway Interchange construction. Marina-Slauson Freeway, Route 90, will cross the San Diego Freeway at Jefferson Boulevard north of the Los Angeles International Airport.

•Planning

ADVANCE PLANNING

To serve Californians in the multitude of activities of over 18 million people, the State Legislature has established a highway system of approximately 16,600 miles. This state highway system, in conjunction with nearly 150,000 miles of local roads and streets, provides the traffic service network for the 9 million plus California motor vehicles that traveled more than 90 billion vehicle-miles in 1965.

With the growth of our state highway system in recent decades, it became evident that a prime network of specially designed highways was needed to meet future travel demands. In recognition of this need, the State Legislature in 1959 established the "California Freeway and Expressway System." This is a master plan of key highways within the overall highway program. The system, comprising 12,500 miles of freeways and expressways, is planned so it links all major recreational, agricultural, industrial, and population areas. Control of access along the many routes of this system will preserve its effectiveness for many years. The accompanying chart shows the present status of freeway and expressway development.

TOTAL NUMBER MILES IN CALIFORNIA JUNE 30, 1966

(STATE HIGHWAY SYSTEM & ALL OTHER)	164,248
TOTAL MILEAGE STATE HIGHWAY SYSTEM	16,598
TOTAL MILEAGE IN OPERATION JUNE 30, 1966 (INCLUDES FREEWAY, EXPRESSWAY, CONVENTIONAL)	14,215
MILES FREEWAY & EXPRESSWAY AUTHORIZED	12,500
MILES FREEWAY ADOPTED	7,323
MILES FREEWAY COMPLETED AND IN USE	1,945
MULTI-LANE EXPRESSWAY AND IN USE	676
MILES TWO LANE EXPRESSWAY AND IN USE	808
REMAINDER OF STATE HIGHWAY SYSTEM IN USE (CONVENTIONAL TWO OR MORE LANES)	10,786

LANDSCAPE ARCHITECTURE

The Division of Highways' staff of professional landscape architects administers a variety of beautification programs designed to enhance the motorist's pleasure in driving.

Highway Planting

Landscape Architecture design and drafting teams prepare plans, specifications and estimates for projects ranging from small tree planting jobs to landscaped urban interchanges costing $700,000 or more. $6.4 million was budgeted for these projects in 1965–66.

Federal Beautificotion Programs

The Federal Highway Beautification Act of 1965 provided federal general funds for outdoor advertising and junkyard control and for the acquisition and development of scenic areas adjacent to highways.

The Landscape Architecture Department has general responsibility for administration of these programs in conjunction with Right of Way, Design, and Urban Planning. During 1966 an inventory was taken of all signs and junkyards visible from federal-aid highways; an estimate was made of the costs of controlling signs and junkyards; a statewide master plan was made for the acquisition and development of scenic areas, with an estimate of costs; a study was made of areas to be landscaped within the right-of-way, with estimated costs; 14 junkyards were screened by planting within the right-of-way, and preparations were made to screen 200 more in the next year; also completed with these funds were 34 planting projects, construction of 6 vista points and 19 right-of-way acquisitions for vista points and roadside rests.

Roadside Rests

Traffic counts and special studies undertaken during the year indicate that public acceptance and use of roadside rest areas is much greater than had been anticipated in some areas—6–9 percent of passing traffic stops at the rest. This has amounted to as much as 700 vehicles per day. Consequently, larger rest areas are being designed for heavily traveled highways and the program is being stepped up to provide more rest areas.

Highway Nursery

Administration of the highways nursery at Davis became a function of this department in July 1966.

Other Activities

During the past year a report was prepared for submission to the Legislature describing the beautification program and defining the criteria for acquisition of scenic areas as required by AB 51. Because of the great public interest in highway beautification, many demands have been made upon the landscape architect for reports, papers, participation in conferences and appearances at public meetings. Notable among these was the Governor's Conference on Beauty, held in Los Angeles in January 1966.

Above, roadside rest on a desert highway is one of many now being provided in state's accelerated program. See below.

SAFETY ROADSIDE RESTS UNDER CONSTRUCTION

DISTRICT	COUNTY	ROUTE	LOCATION	TRAFFIC DIRECTION
2	Plumas	36	E. of Chester	Both
3	Glenn	5	2 Mi. S. of Artois, near Willows	Northbound
3	Glenn	5	2 Mi. S. of Artois, near Willows	Southbound
6	Kern	5	3.3 Mi. N. of LA Co. Line, Lebec	Northbound
7	Los Angeles	5	2.4 Mi. N. of LA City Limits	Southbound
9	Inyo	395	10 Mi. N. of Independence	Both
9	Kern	395	Near Inyokern	Both
10	Stanislaus	5	0.9 Mi. S. of San Joaquin County Line	Northbound
10	Stanislaus	5	0.9 Mi. S. of San Joaquin County Line	Southbound
11	Riverside	10	Cactus City, 18 Mi. E. of Indio	Eastbound
11	Riverside	10	Cactus City, 18 Mi. E. of Indio	Westbound
11	San Diego	5	At La Costa Interchange	Both
	PROGRAMMED FOR CONSTRUCTION IN CURRENT BUDGET			
1	Mendocino	101	At Moss Cove, 10.5 Mi. S. of Laytonville	Southbound
1	Mendocino	101	At Irvine Lodge, 7.9 Mi. S. of Laytonville	Northbound
1	Mendocino	101	At Empire Camp, 2.6 Mi. S. of Cummings Post Office	Northbound
2	Lassen	395	7.7 Mi. N. of Milford	Both
2	Lassen	395	4.8 Mi. N. of Madeline	Both
2	Plumas	70	1.5 Mi. W. of Rte. 89 near Keddie	Both
2	Plumas	70	6.5 Mi. E. of Quincy	Both
2	Shasta	44	3.2 Mi. E. of Shingletown	Both
2	Shasta	299	3.9 Mi. E. of Montgomery Creek	Both
2	Modoc	299	8.9 Mi. NE of Adin	Both
2	Trinity	299	5.0 Mi. E. of Weaverville	Both
2	Siskiyou	97	21.8 Mi. N. of Weed, Grass Lake	Both
3	Butte	70	0.1 Mi. E. West Branch Bridge	Both
3	Nevada	20	4.1 Mi. E. of Washington Junction, Alpha Omega	Both
3	Yuba-Sierra	49	Yuba-Sierra Co. line	Both
3	Placer	80	Near Gold Run	Eastbound
3	Placer	80	Near Gold Run	Westbound
4	San Mateo	280	N. of Crystal Springs Rd. overlooking S.F. Reservior	Northbound
5	San Luis Obispo	46	At Cholame Valley Rd. near Cholame	Both
5	Monterey	101	2.5 Mi. North of Camp Roberts	Northbound
5	Santa Barbara	101	0.6 Mi. S. of Gaviota Tunnel	Northbound
5	Santa Barbara	101	0.6 Mi. S. of Gaviota Tunnel	Southbound
9	Kern	14	At Red Rock Canyon	Both
9	Mono	395	2.2 Mi. N. of Casa Diablo	Both
9	Inyo	395	At Haiwee, 10.5 Mi. S. of Olancha	Both

TRAFFIC

Computer Processing of Accidents

Although there has been a general decline in accident rates over the past years, the substantial increase in vehicle-miles of travel has resulted in an increase in accidents and fatalities. There is also an increasing awareness by the public of the human suffering and economic loss associated with traffic accidents. This has been brought into focus by the recent enactment of the Federal Traffic Safety Act of 1966. Undoubtedly a point has been reached where more time, more effort and more money must be spent to reduce accidents.

The California Division of Highways has used electronic data-processing methods for many years to provide statewide summaries of accident data. Only recently has the computer been applied to the problem of identifying, comparing, and analyzing spot accident locations. Computers can handle an increasing volume of work at reasonable costs.

The California Highway Patrol and city police departments provide copies of all state highway accident reports to the Division of Highways. The accident reports are forwarded to Headquarters Traffic Department, where coder-interpreters pick off information from nearly 120,000 accident reports annually. This information is placed on data-processing tapes for later use.

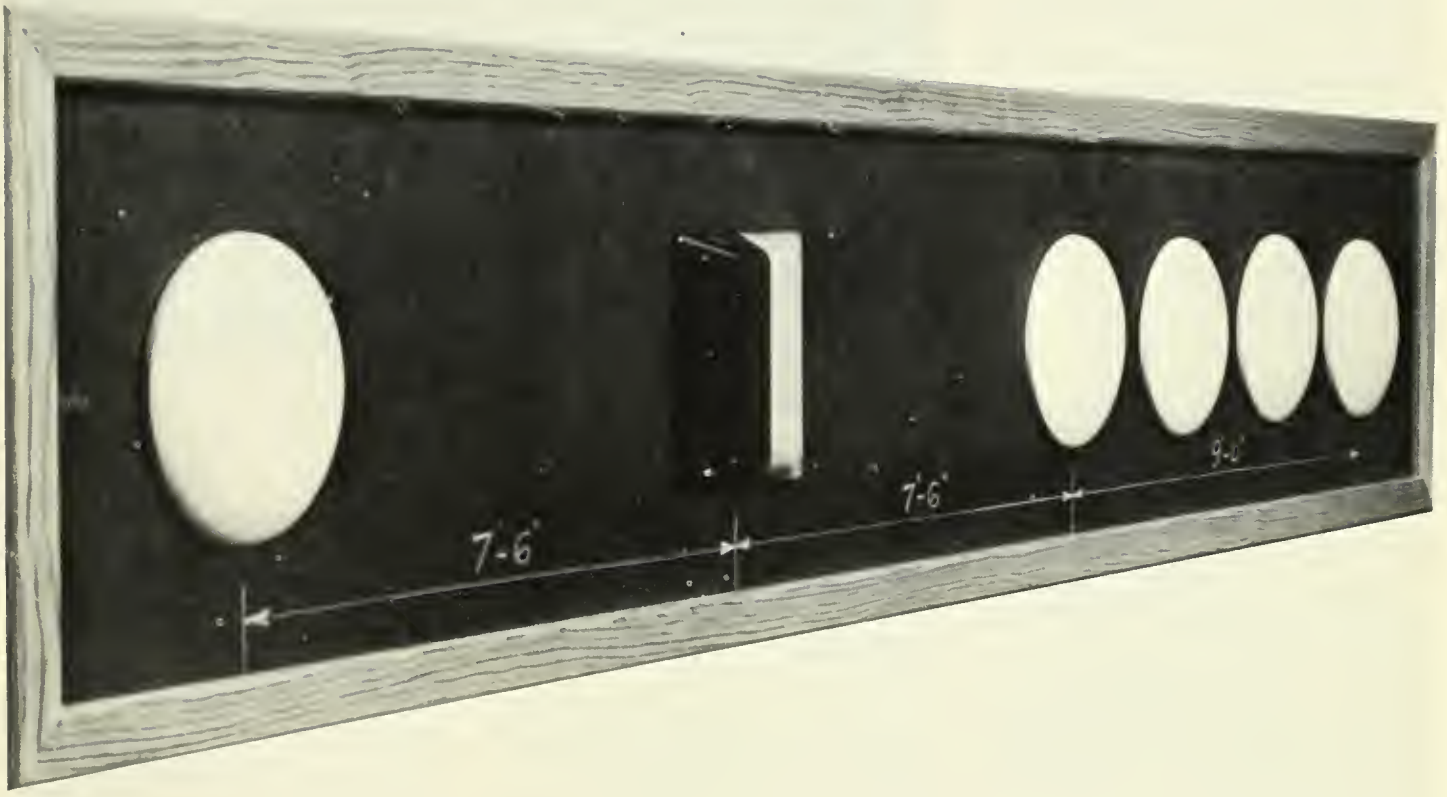
California has established a milepost system, accurate to the nearest 1/100 of a mile, which provides for the accurate location of all accidents. Markers are spaced from 2/10 to 5/10 of a mile apart in urban areas and at one-mile increments in rural areas. In addition, all structures are marked with milepost markers.

The approximate cost to install this system on the existing 14,215 miles of the state highway system was $400,000. Installation was over two fiscal years. In addition, there is now a pilot study of milepost markers on the 5,000 ramps of the state highway system, costing approximately $100,000. To have an effective surveillance system it is necessary to know precisely where ramp accidents occur.

The accidents listed are grouped into three parts.

A. The first part shows each milepost location where there is one or more accidents.

B. The second part shows cumulative numbers of accidents from the beginning milepost within each county route.



Model shows arrangement of reflectorized pavement markers adopted for California highways during reporting year. Sequence is 4 white "button" types spread over 9 feet of paving, with a 7½-foot gap, then a reflecting "prism" type marker, which shows white to oncoming traffic, and red to wrong-way drivers.

C. The third part shows concentrations of three or more accidents within any single "floating" tenth-mile increment. The computer determines the tenth-mile increment which has the greatest number of accidents. In addition, the prevalent type of accident (rear-end, turning, broadside, etc.) for each concentration is listed. This tells where the concentrations are by milepost, how big they are, and a rough idea of the type of accident problem.

A second print-out is a quarterly accident concentration listing. This tabulation compares the relative severity of the different accident locations.

There has been a program of spot safety improvements on existing highways for many years. These improvements range in cost from a few hundred dollars to as much as $1,000,000 each, and include the complete field of traffic engineering techniques and traffic control devices. Some $7,000,000 to $8,000,000 on some 300 such safety improvement projects is spent each year. These do not include the numerous improvements in signing, striping, and many of the minor safety improvements which are done by state maintenance forces.

Recently completed is a comprehensive inventory of the entire state highway system to identify and devise solutions for all accident concentration locations. This inventory was completed under requirements of the Bureau of Public Roads, and illustrates the usefulness of the surveillance tabulations. The traffic engineers studied the tabulations and accident records and made field investigations at locations that have been having five or more total accidents per year. From this study and investigation, improvement projects were proposed at all locations where reduction or elimination of the accident problem was considered feasible.

A priority program has now been scheduled based on this evaluation process. Plans are going ahead to correct about 1,700 locations at a cost of $30,000,000 in state and federal funds with an additional $6,500,000 in cooperative funds from local jurisdictions. In line with policies of the Bureau of Public Roads, these 1,700 projects will be completed by September 1, 1969. It is estimated that there will be 4,800 fewer accidents per year when all projects are completed in 1969. Expenditures for all safety improvement projects under this new program will increase by about 50 percent

over average expenditures of the past few years.

An analysis of 500 "before and after" reports now under way indicates an overall reduction in accidents of about 23 percent. Of course, not all safety improvement projects showed an accident reduction, and the amount of improvement varied not only by the type of improvement but from project to project.

With the advent of the new generation of computers embodying real-time, direct access concepts, there will be a time when it will be possible literally to press a button and almost immediately receive complete accident histories, along with traffic and site information, for any location desired.

Also during the reporting year, pavement arrows were changed to the new type to give better visibility.

The California Traffic Count Program

The State of California has a continuous program for counting highway traffic. Since 1960, portable mechanical traffic counters actuated by an impulse on a rubber pneumatic hose stretched across the road have been used to obtain traffic counts. Traffic is counted annually at over 16,000 locations on California's 14,215-mile state highway network.

Currently underway is a feasibility study of a combined telemeter-microwave data acquisition and traffic control network which will gather count data from about 200 key locations in all parts of California. The network will be controlled by a central command and operating system which will perpetually monitor the progress of vehicles at network locations.

Electrical

In a continuing program to make highways safer, division engineers look for methods of reducing the number of fixed objects on freeways and to make safer those which are required.

A recent change in highway lighting design provides higher and wider spaced lighting poles (40 feet instead of 30) thus reducing the total number of poles. In addition a longer luminaire mast is provided so the poles can be located farther from the traveled way (18 feet instead of 12). Perhaps more significant is the provision of a cast aluminum base which dynamic tests have proven will break when hit by a car and allow the pole to roll over the top of the vehicle. This prevents the damage and injury which results when a vehicle collides with a fixed steel pole.

The findings of the Traffic Department's study of accidents involving fixed objects indicate that the frequency of accidents involving fixed objects in the gore location is approximately four times that of similar fixed objects mounted off the shoulder or in the median.

Signing

Steel post signs will no longer be installed in freeway gores. Where overhead signing is needed it will be the practice to install the sign directing to the exit as a left-hand cantilever 100 feet to 150 feet ahead of the gore. Where the signing would also include a message over the freeway, this message will be installed on an overcrossing structure where possible, or on a second left-hand cantilever usually a minimum distance of 500 feet beyond the first cantilever sign. This second cantilever should be combined with an existing fixed object wherever possible.

Traffic Markers

The traffic stripe has recently been termed a fair weather friend. Everyone is aware that the traffic line is lost under moderate to heavy rainfall, particularly during the hours of darkness. This has become a more serious matter with the development of multilane freeways. A six- or eight-lane freeway on a rainy night becomes a broad sea of pavement with no delineation.

In 1954 the late Dr. E. D. Botts of the Materials and Research Department of the California Division of Highways developed a type of raised button or dot as a substitute for the painted white line. The original dots and wedges were made with reflectorized concrete. However the concrete did not prove as durable as the polyester or epoxy-type resin plastic markers now being used.

The first use of these raised markers was the placement of reflective wedges in lieu of stripe on three miles of northbound lanes of the Route 99 Freeway near Sacramento as an experimental installation. Although these wedges were widely spaced by present standards, they effectively guided traffic for some 10 years. Widening of the highway in 1965 required their removal.

The 1961 State of California Assembly adopted a resolution that the Division of Highways, Department of Motor Vehicles and the California Highway Patrol make a study of lane dividers for the purpose of devising methods and materials which would retain highway markings at night during periods of bad weather. The Materials and Research Department of the Division of Highways installed many test sections using various types of raised lines or markers.

Subsequently the state made several installations, first of reflective dots at three-foot centers to simulate the lane line, and later with reflective wedges. Also used were yellow wedges to supplement the yellow line at problem locations. Primarily, because of the disappointing appearance of full-beaded markers as a daylight line, composite dots and wedges were developed which have a plain plastic top but use the beads on those edges of the marker which are at the best angle to reflect the light from the headlights. Although still making some installations of markers in lieu of stripe, the state program during the last few years has been primarily to supplement the painted line with beaded or partially beaded markers in the gap. Many miles of such supplemental markers were installed, particularly in the heavier rainfall areas of the northerly coast counties.

As a result a circular letter issued December 3, 1965, stated:

"Raised pavement markers shall be used in lieu of painted lane lines on all future multilane freeways, expressways, and two-lane rural highways in areas that do not involve snow removal. They should be included as a contract item in future projects. Change orders shall be submitted immediately on all current state highway contracts, where conditions permit".

Further experiments are being made with yellow markers to supplement yellow barrier lines, but these barrier and semibarrier lines as painted lines will be retained for the time being.

In the high mountain areas where snowplows operate frequently it has been impossible to retain a painted line during the winter season. In 1964 a one-mile section in each direction on Interstate 80 was provided with plain and reflective markers set in drilled holes flush with the pavement surface. This insert marker did provide a reasonably effective line under these difficult conditions.

Reduced Visibility (Fog) Study

Senate Resolution 33 (1963 session) requested the Transportation Agency to determine possible means of warning motorists of the need to drive with greater caution during periods of reduced visibility.

A joint effort of the Department of Motor Vehicles, the California Highway Patrol, the Institute of Transportation and Traffic Engineering and the Division of Highways was launched to implement the Senate resolution.

Generally, drivers were found to accommodate to reduced visibility by voluntarily reducing their speeds about five miles per hour. Additional moderate reductions were observed when electric speed limit signs were displayed in daylight under moderate traffic conditions. Some changes were also noted when Highway Patrol units were deployed. AM radio appeals during "fog alerts" were found ineffective in causing a change, either because the appeals were ignored or were not heard in quantity sufficient to do a "selling job."

Reporting Highway Accidents

This study showed that 49 percent of all accidents on the state highway system are reported. One hundred percent of the fatal accidents, 93 percent of the injury accidents and 38 percent of the property-damage-only accidents were reported. On roads patrolled by the California Highway Patrol 54 percent of the accidents were reported, whereas 39 percent were reported on streets under the jurisdiction of city police departments. The study also showed that only 18 percent of single-vehicle accidents were reported, but that 53 percent of the accidents involving two or more vehicles were reported. Somewhat surprisingly, only 47 percent of the accidents occurring in the daytime were reported, while 67 percent occurring at night were investigated and reported by the police.

Relating Highway Elements to Accidents

Highway safety is affected by standards of design. Experience has demonstrated that access control, flat curves, gentle grades, adequate sight distance, freedom from fixed objects, gradual changes, flat side slopes, etc., help reduce accidents.

Improvements in each of the many design elements will be related to accident rates and numbers. All geometric features known or suspected to affect safety will be studied. Since the study encompasses a large and complex field, it will be a continuing study divided into many subprojects for convenience of analysis.

Compiling of a roadway inventory has progressed to the point where all the field and office work to code the geometry has been completed on approximately 1,500 miles of freeway. The next step is to program data for computer analysis and put the inventory on computer tape.

Below: Overall view of test area on Route 5 in Kern County, showing diagonal and longitudinal scoring of a portland cement concrete pavement for improving its skid resistance.

URBAN PLANNING

The Bay Area Transportation Study Commission, its data collection virtually completed, has made substantial progress toward decision making on the final plan alternatives it must submit to the Governor and the Legislature by 1968.

From the standpoint of the nearly 4,000,000 people who now live and work in the nine bay area counties included in the survey, there is now a firm foundation from which to realize a return on the $4,500,000 invested in the study.

Created in 1963 by legislation introduced by State Senator "J" Eugene McAteer of San Francisco, the commission is made up of 37 members representing various federal, state and local agencies of government. It is financed from contributions of the United States Department of Commerce (Bureau of Public Roads); the U.S. Housing and Urban Development Department; the Association of Bay Area Governments; the State Division of Highways and the Bay Area Rapid Transit District.

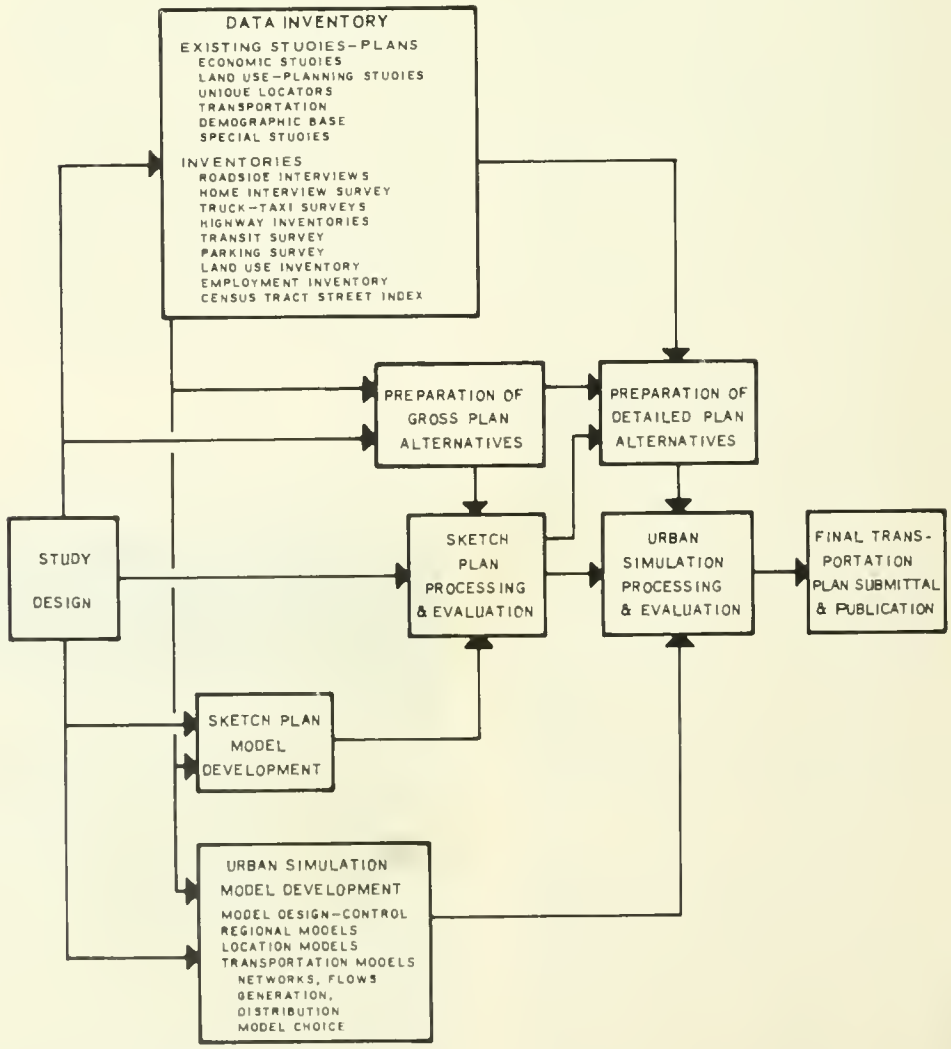
For residents of the area—and to the hundreds of thousands of people for whom the bay area is a traffic "corridor"—the direct benefit will be in the commission's recommendations for a balanced, regional transportation plan. This planning must provide for moving people and goods within and through the bay region, in the period of the 1980's and beyond, when population forecasts indicate more than 7,000,000 persons will be living there.

Through use of computers, the commission will analyze its data, obtained by thousands of interviews with motorists, householders and business concerns, to obtain prospective plan choices which offer the greatest possibilities from the point of cost, convenience and traffic service. The same general planning criteria will be applied to proposed choices of transportation facilities.

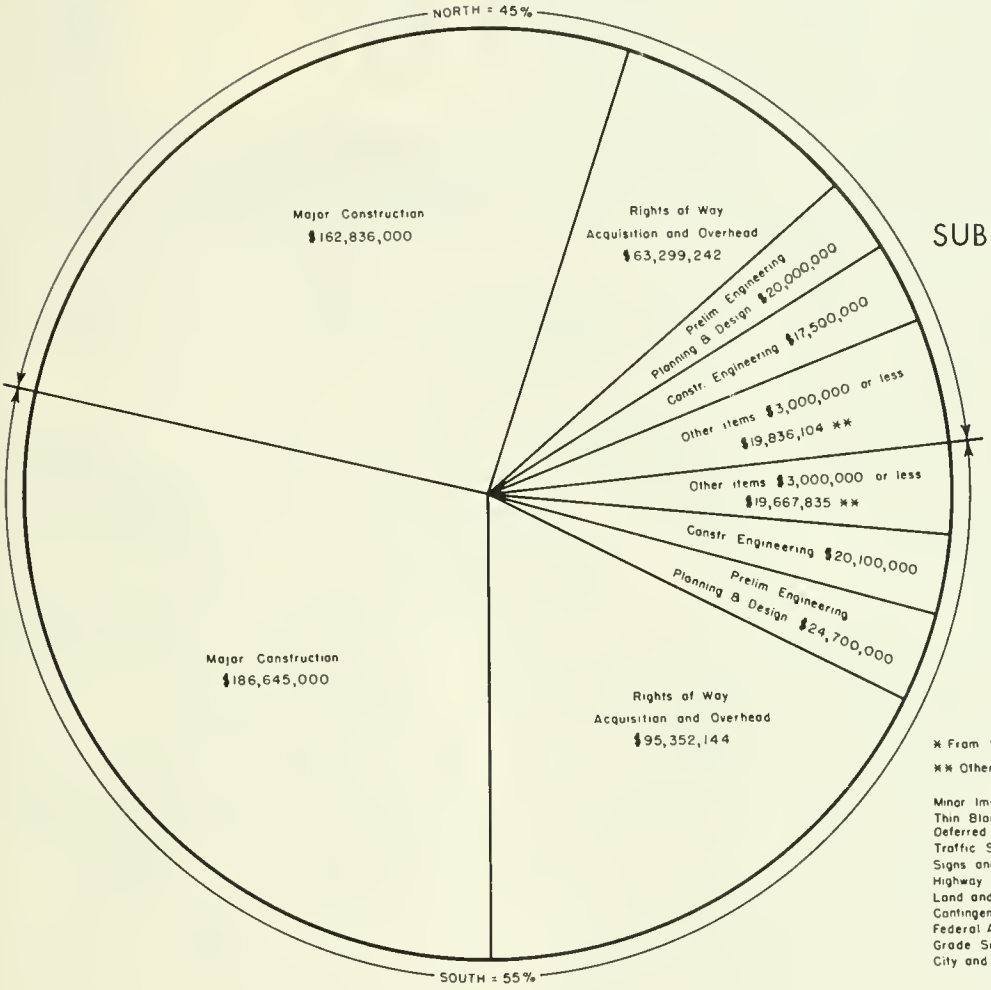
A distinctive feature of the commission, and one that is expected to play a strong role in gaining public acceptance for the commission's work is the inclusion in the group of numerous members of boards of supervisors and city councils within its ranks, as well as business, labor and civic leaders. In addition to the commission itself, there is a citizens' advisory committee of 50 members.

The bay area transportation study is one of nine similar studies in California. It is, however, the only one with a commission established by state legislation. The status of the other studies ranges from those just being organized to those which have been operating continuously for nearly 10 years. These studies in the urbanized areas include nearly 90 percent of the state's population.

The chart below diagrams the normal flow of current transportation studies beginning with massive collection of data followed by technical analysis and culminating in submittal of a transportation plan. Modern-day analytic procedures are subject to extremely rapid development, especially because they are closely related to the swift advancement of computer technology.



PROGRAMS AND BUDGETS



1965/66 F.Y. BUDGET

SUBJECT TO NORTH-SOUTH SPLIT

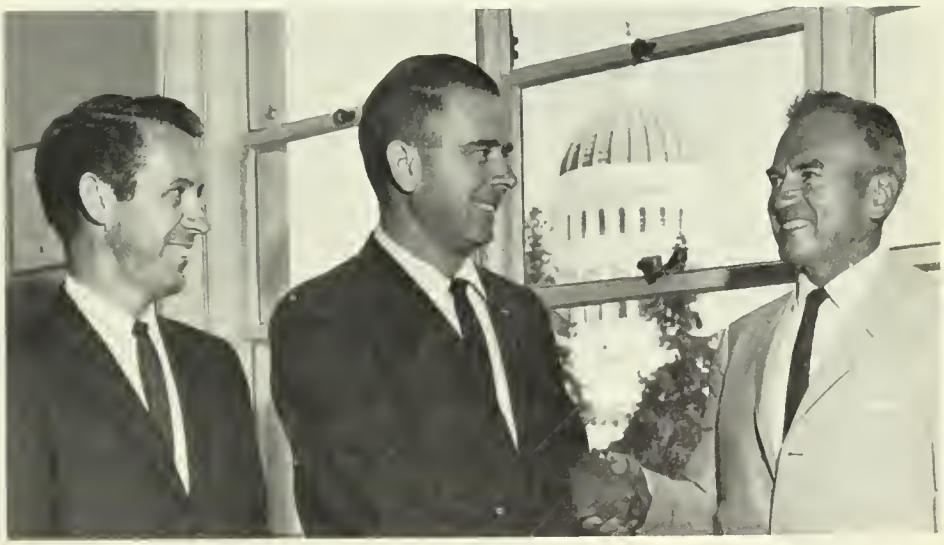
Total Subject to Split $629,936,325 *

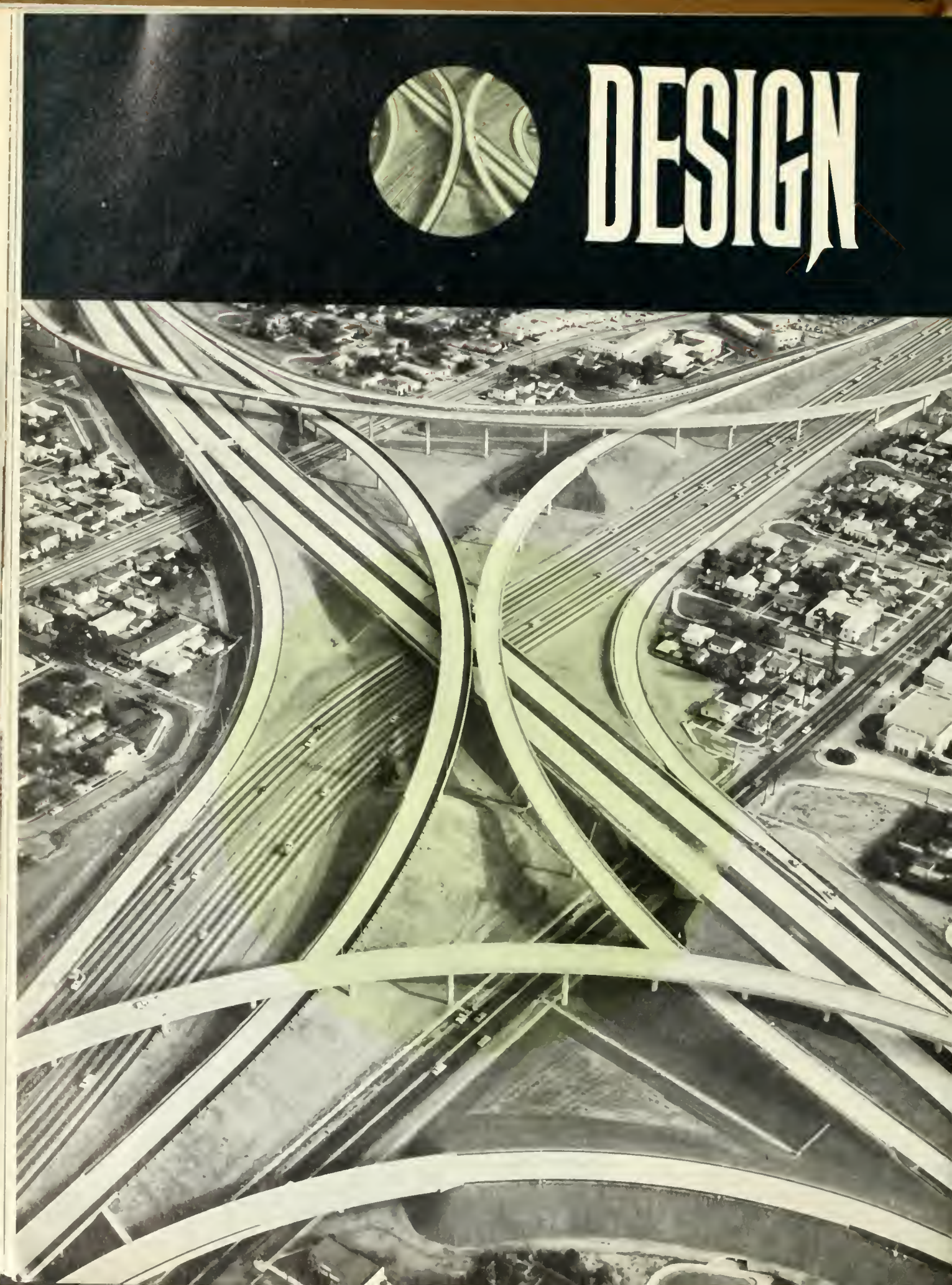
* From State Highway Budget adopted by C H C. 10/29/64

** Other items $3,000,000 or less consists of

	NORTH	SOUTH
Minor Improvement and Betterment	$ 650,000	$ 350,000
Thin Blanket Program and Deferred Seal Coats	2,700,000	1,800,000
Traffic Safety Projects	1,000,000	2,000,000
Signs and Striping	2,100,000	2,400,000
Highway Planning	1,000,000	2,000,000
Land and Buildings	2,000,000	3,000,000
Contingencies	3,000,000	3,000,000
Federal Aid Secondary Matching	2,890,604	1,216,835
Grade Separations	2,250,000	2,750,000
City and County Urban Extensions	2,245,500	1,151,000
TOTAL	$19,836,104	$19,667,835

Comptroller John Burrill (right) congratulates Sam Zivkovich (left) and Tom Hawkinson for their maximum $150 award received from their joint merit award suggestion. Their suggestion was that federal highway reimbursement funds be picked up in San Francisco and immediately deposited in a bank rather than go through normal channels for transmittal to Sacramento which might take anywhere from a day to a week. The extra interest computed daily on the more than $300,000,000 dollars handled yearly will bring into the state an additional $160,000 a year. Upon proof of total savings to the State Highway Fund through this practice, the suggesters may receive the highest single award ever made by the State Merit Award Board. Highest single award to date was $11,808 awarded in 1959 to Andrew Schoellkopf of the Division of Highways.

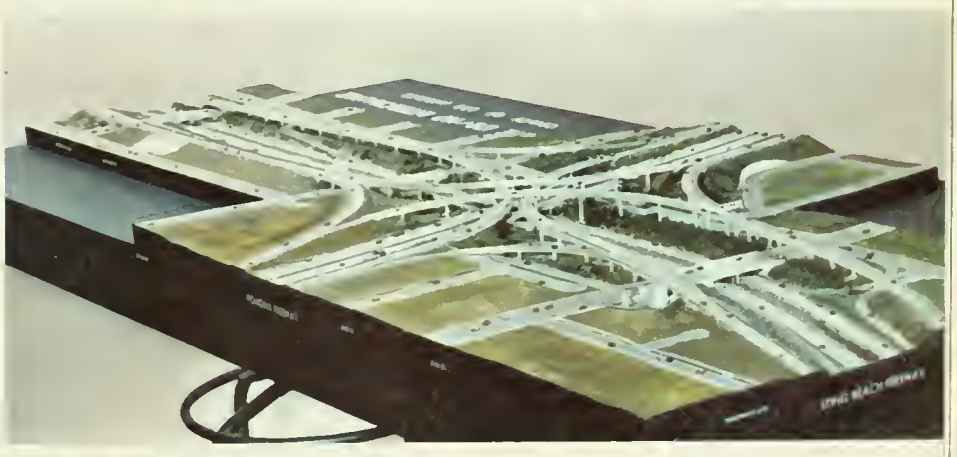



DESIGN

Above: Two examples of variations in design being used in current construction jobs in the Sacramento area. Since urban design involves the pedestrian's view as well as that of the motorist, new ideas such as these are being incorporated into structures to make them more pleasing in the city landscape.

Modern highway design recognizes the need to serve traffic with safety while preserving the amenities of the environment. The designer who today is using all the modern mechanical tools such as computers, photogrammetry, and electronic measuring devices, must still be sensitive to the factors which make up the environment.

The pictures on these four pages illustrate the variety of situations which may be encountered, as well as some of the methods used in reaching satisfying solutions. It must be kept in mind that environment can mean city streets and slow moving pedestrians, a quiet residential area, or the vast open spaces of the mountains and desert.



Above and left: Models of this type are constructed so that geometrics of traffic service, physical relationship to adjacent property, highway safety and aesthetic impact may be studied during design of a project.

Seattle Public Library
JAN 26 1967

Above: Safety and traffic expedition are both served by the freeway which handles traffic at high speed which would otherwise hopelessly clog the adjacent city streets. Note how landscaping separates freeway from residential area. Right: Route 99 through the City of Chico in Butte County. Bidwell Park is in the center of the picture. The viaduct through the park provides continuity for full enjoyment of this large park.

Above: Artists rendition of an interchange between two freeways. Sketches of this type are prepared for study purposes to show how the freeways will fit into the community. Above right: A good multiple use of the freeway right-of-way is illustrated by this elevated structure with parking beneath it. Below: Retaining wall receives aesthetic treatment on Interstate 580 in Alameda County. The rounded top of the wall and the color contrast treatment provide a pleasing diversion for what might have been a large blank wall. As landscaping plants grow, effect will be enhanced.

Above: Interstate Route 15 in San Bernardino County. The highway location is well matched to the terrain.

Below: Split level design on Interstate 80 in Nevada County. Native vegetotion has been retained in the median. The majesty that is the high Sierra is more easily enjoyed through the use of this free flowing alignment leading the traveler over Donner Summit.

BRIDGES -

Above: This structure combines a liberal use of rubble masonry in abutment retaining walls, with heavily textured abutment and pier faces, sloping girder sides and an anodized aluminum railing. (Fairground Road Overcrossing in Monterey County.) Below: Sloping sides on the girders, tapered columns and long sweeping lines combine to give grace to this section of elevated freeway. Beneath is a huge area which may be used for a variety of purposes. (Fort Sutter Viaduct in Sacramento.)

California's bridges are taking on a new look. Throughout the nation, highway aesthetics have become a major interest. Here in California the demand for better looking highways has been received with considerable pleasure. Although our designers have been striving for years to achieve the best in structure appearance, the budget for beautification has never been very large. Now, with the new aesthetic impetus, money is available to improve the appearance of structures. Many new ideas have been on the drawing boards for several years. This year many of these plans went to contract and the public began ro see some stimulating new designs.

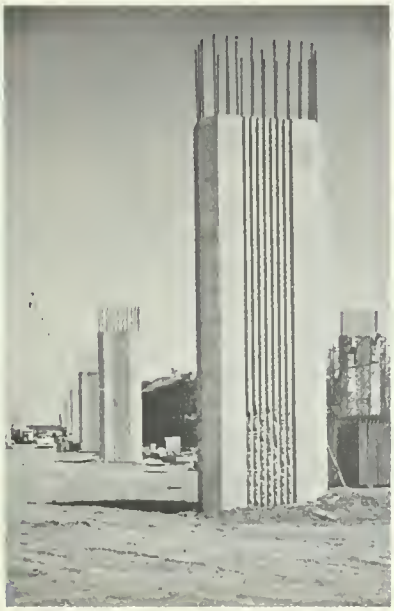
The new look in bridges employs form, texture, and color. All of these have been used to advanrage to create more exciting structures. For example, many bridge girders are being given sloping sides getting away from the structurally efficient but not always pleasing square corners. Besides a more interesting look, this keeps the girder faces in shadow most of the time, and the sloping faces minimize the apparent depth of the girders. In some cases the corners have been completely eliminated so the structure achieves a lighter look.

The first structure built on the Junipero Serra Freeway south of San Francisco near San Jose was given a continuously curved profile across the underside of the bridge, and the effect is of extreme thinness and lightness. The Fort Sutter Viaduct in Sacramento has sloping sides on the girders. There are many other designs now in progress with variations of these themes.

Variety in the design of the supports is another innovation. Getting away from the traditional and more economical plain round, square or rectangular columns, the new columns may be tapered or shaped, rounded, oval or multisided. With these curves and tapers, the structures take on a dynamic feeling. Those being built in Sacramento illustrate this in a striking manner.

Textures are being widely used to break up plain faces and add interest. A variety of textures are being used on bridge piers to add interest to otherwise plain faces. Retaining walls, notorious for their long plain glaring faces, are being given intermittent panels of texture to interrupt the monotony. These run the gamut from

THE NEW LOOK



Above left: To add interest to long areas of retaining wall face, exposed aggregate panels were specified. The exposed pebbles are about 50 percent white, with the remainder ranging from light gray to black. (Fort Sutter Viaduct in Sacramento.) Above right: Here an interesting texture relieves what would have been a plain smooth face of concrete on these bridge piers. (The American River Bridge at Sacramento.)

Below left: The most extreme example of curved steel girders on a major structure built to date. This ramp describes a full 180° in curved steel. (Pioneer Memorial Bridge Approach Ramps in West Sacramento.) Below right: One of the new designs on the Junipero Serra Freeway. The continuously curving cross-section minimizes the depth of the superstructure. (Mora Drive Overcrossing in Santa Clara County.)

light textures cast into the concrete, as was done in some of the walls in Oakland, to interspersed panels of rubble masonry or rock-lined planting niches, as in Nevada City. Colored panels help to interrupt monotony. A color may in itself add life to an otherwise drab structure. California has for some time been painting the steel bridges a dark green. In an effort to make the colors more compatible with their surroundings, new colors in the golden tan range are being tried, for matching California's golden hills. They blend remarkably in areas where for nine months of the year dry grass dominates the landscape. The first of these new colors was put on a bridge in the San Bernardino area and more are planned throughout the state.

Appearance and aesthetics are emotional things, and people's tastes vary, Hence, every effort is made to strike a middle ground. Bridges will be in service for many years, and it is important that the designs not follow any faddish trend which may make them look out of place in some future design age. Every new design tried opens a new vista and an opportunity for greater improvement.

Some of the ideas have not gone far enough. Some were possibly applied too enthusiastically. Some of the textures applied to walls were not deep enough, and more contrast is needed for a good effect. Some textures applied to walls were used too extensively so that the texture itself became monotonous. Future installations will be made more interesting by interspersing the textures.

A structure worthy of comment is the San Mateo Creek Bridge, now nearing completion on the Junipero Serra Freeway south of San Francisco at the Crystal Springs Dam. In an especially attractive location, this 1,700-foot bridge, crossing a canyon 250 feet deep, has been designed to complement the beautiful site. The concept was a light, open structure which would cross the deep canyon with a minimum of distracting detail and be an asset to the environment. As the steel girders creep across the tall gothic piers to meet high in the center span, the dream of the designer is rapidly taking shape.

With approximately 500 bridges being built during the year, at any given time there are a number of interesting ones under construction. One extensive complex of struc-

Left: An imaginative pier design lends character to this simple steel girder structure. (Dry Creek Bridge in Amador County.) Below: One of the new Junipero Serra designs in which the superstructure is shaped to minimize the effect of its depth and the unique pier design adds interest. (Magdalena Avenue Undercrossing in San Clara County.)

Below: A precast and prestressed concrete bridge which won an award in a national prestressed concrete competition. Its trim, simple lines give it exceptional grace as it carries the highway over a deep canyon. (Los Penasquitos Creek Bridge in San Diego County.)

tures is the group forming a four-level interchange between two freeways (Routes 90 and 405) in Los Angeles. Costing some $15 million for the entire interchange, half of the cost is in the structures. The first unit is now being built. The necessity of maintaining traffic through the work has required many construction innovations.

Another challenging design problem was solved this year with the opening of the Crestline Interchange high on the mountainside above San Bernardino. Notched into the precipitous slopes and using five very sizable sidehill viaducts, an interchange has been built in an almost impossible location to separate the traffic on a four-lane heavily traveled route to the mountain recreation areas.

Probably one of the best measures of California's success in meeting the challenge of better looking structures is the continual year-by-year series of awards won in national contests seeking outstanding bridge aesthetics. Each year the steel industry sponsors two different contests. California has consistently received awards almost every year. In 1965, in one contest, four of an available 18 prizes came to California. In 1966 there were two awards in this countrywide competition. Awards have also been won in the concrete bridge field in national competition. Another item of pride was that men from the California Bridge Department carried away six of the 13 available prizes in a worldwide competition for steel bridge design. California is well staffed to meet the aesthetic challenge.

Safety too, is a prime consideration in bridge design. During the past year, the policy was definitely set that wherever possible bridge columns and piers would not be placed near the right shoulder of a freeway where they could be hit. This requires some longer spans and the removal of these fixed objects which have spelled destruction to some vehicles out of control. As a result, a great majority of the separation structures are being designed as two-span rather than four-span bridges to eliminate two supporting piers. These longer spans also look better.

The bridge railing has come in for much comment both pro and con. While admitting that the primary function of a railing is to keep a

vehicle from running off the bridge, many people also wanted to be able to see out across the country. To meet this criticism, a new steel rail was designed with only two horizontal members and no curbing. The visibility was excellent. Oddly enough, it turned out to be too good. After some of this railing was installed high on a mountainside near San Bernardino, it was found the visibility was so good that travelers looked through into thin air beyond, became uneasy and invariably moved over away from the rail. It was obvious that they wanted visibility out but they did not want to see through down near the deck where they got a sensation of great height. So, another design has been worked out combining the best features of both railings. A low concrete parapet is surmounted by a single rectangular tube only two inches thick. The view down is blocked by the parapet, which also is very effective as a collision barrier. The view out is almost unobstructed by the two-inch tube. This railing will see wide application and will provide the maximum visibility with complete safety.

Vertical clearance under structures has also received considerable study this year—both the permanent clearance and the clearance during construction. Falsework clearance is especially critical. With the longer spans being built, falsework is essential. Yet, in many locations, traffic is so heavy that an impairment of the available clearance even during the construction period presents problems. Although the legal height limit is 13′ 6″, higher permit loads or loads of illegal height often hit the falsework, occasionally with disastrous results. As a general thing it has been established that falsework will be at least 14′ 0″ and preferably 14′ 6″ clear. Although this may in some cases necessitate raising the approach grades somewhat, the safety during construction is considered to be of paramount importance. Horizontal clearance is also being studied with an eye to achieving the safest possible arrangement commensurate with the cost and construction requirements.

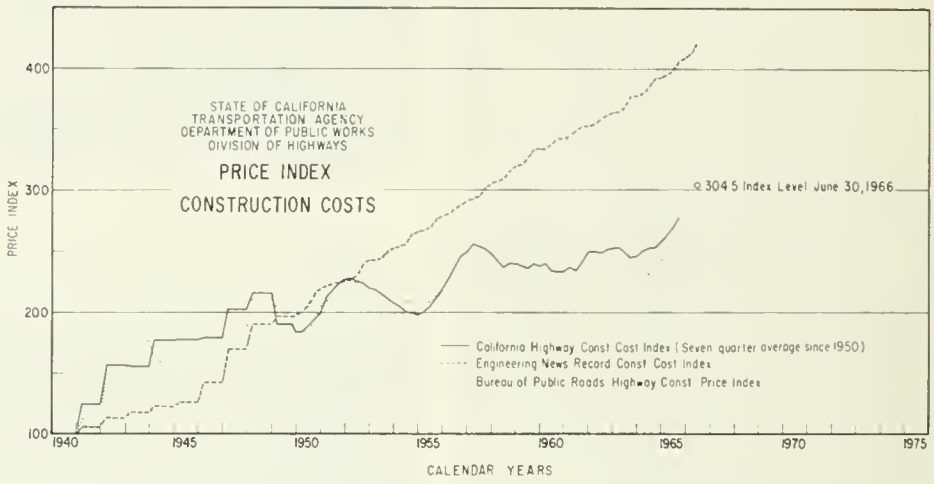
Bridge designing and construction has shown a steady increase. Currently the bridge budget runs about $120,000,000 for more than 500 bridges each year. A continuing budget of this sort requires turning out plans for two bridges and completing the construction of two bridges each working day.

A welded steel girder structure which won a steel contest award in 1966 for its clean, simple lines. (Willow Creek Bridge in Humboldt County.)

Above: The clean lines of the new concrete structure on its high, slim, rounded piers contrasts with the old sharply curved timber trestle which carried the traffic for past years (Caspar Creek Bridge on the Mendocino Coast.) Below: A high level, welded steel plate girder bridge which gracefully carries as many as 10 lanes of traffic over the Sacramento River. Although built on a huge scale, its lines reduce to a thin ribbon. (Pioneer Memorial Bridge in Sacramento.)

• Administration

OFFICE ENGINEERS



Prequalification of Contractors

Prequalification is required of all contractors who desire to bid on state highway projects estimated to cost more than $50,000. The prequalification rating, representing the maximum bidding capacity for each of the several types of work which a bidder is capable, is established from a review of each contractor's statement of experience and financial condition.

On June 30, 1966, there were 812 contractors prequalified to bid on the various types of state highway construction, with a combined bidding capacity of $2,826,260,000. The following tabulation gives the number of contractors prequalified on June 30, 1966, arranged by the several brackets of bid ratings:

Rating	*Number of contractors*
$10,000,000 and over	91
5,000,000 to $10,000,000	163
2,500,000 to 5,000,000	248
1,500,000 to 2,500,000	316
1,000,000 to 1,500,000	405
500,000 to 1,000,000	515
250,000 to 500,000	683
100,000 to 250,000	773
50,000 to 100,000	812

Contracts awarded during the year have been arranged in eight value ranges as shown in the accompanying "Contract Value Range" table:

Construction Cost Index

The California Highway Construction Index reflects changes in highway construction costs. The index is founded on weighted average contract prices for seven principal construction items, all referred to the base year of 1940 with a value of 100. The accompanying graph shows a comparison between the California Index, the Bureau of Public Roads Index, and the Engineering News-Record Construction Cost Index. The latter two indices are based on nationwide construction costs. The California Index is plotted on an average basis which smooths out fluctuations.

CONTRACT VALUE RANGE
Number and Value of Projects

	Number of projects	*Percent*	*Value of projects*	*Percent*
Under $50,000	279	44.2	$5,625,188	1.5
50,000 to $100,000	68	10.8	4,713,557	1.3
100,000 to 250,000	118	18.7	19,312,943	5.1
250,000 to 500,000	55	8.7	19,768,939	5.2
500,000 to 1,000,000	31	4.9	22,019,294	5.8
1,000,000 to 2,500,000	36	5.7	55,190,523	14.6
2,500,000 to 5,000,000	19	3.0	67,701,061	17.9
Over $5,000,000	25	4.0	183,174,030	48.6
Total	631	100.0	$377,505,535	100.0

First Official Highway Map

The first California Official Highway Map to be printed by the Office of State Printing is being prepared by a newly created cartographic section which is using the most modern facilities and techniques of engraving and photolithography.

A small department of only four people had to start from scratch and within 11 months do the necessary research, learn the scribing techniques and create some 38 overlays and the relief background.

The map is designed in such a way that the Supplement to the Annual Report and the Freeway and Expressway Progress maps can be created through the use of selected overlays, plus a few additional overlays. This eliminates duplication of effort and provides high quality cartographic materials for these needs.

This method also has a considerable potential through which other state departments may improve the quality of their published maps at a lower cost, by the selection of desired overlays and preparation of necessary new ones.

Finally, an effective retrieval file system has been set up for collection and dissemination of information for future issues of the map.

Financial Aid for City-County Roads

Above: Senate Bill 380 enacted a few days before the beginning of the fiscal year, clarified and extended the provisions of the Collier-Unruh Local Transportation Development Act so as to benefit the cities and counties which were having trouble providing the local matching funds required.

Below: View of Route 70 in Marysville, with new median dividers and traffic storage lanes under construction. This is a typical improvement being made in many major arteries in California cities.

•Legal

The most significant legal development in recent years is the imposition upon the state of liability for dangerous conditions of public property. This permits suits against the state for money damages as a result of death, injuries to persons or property.

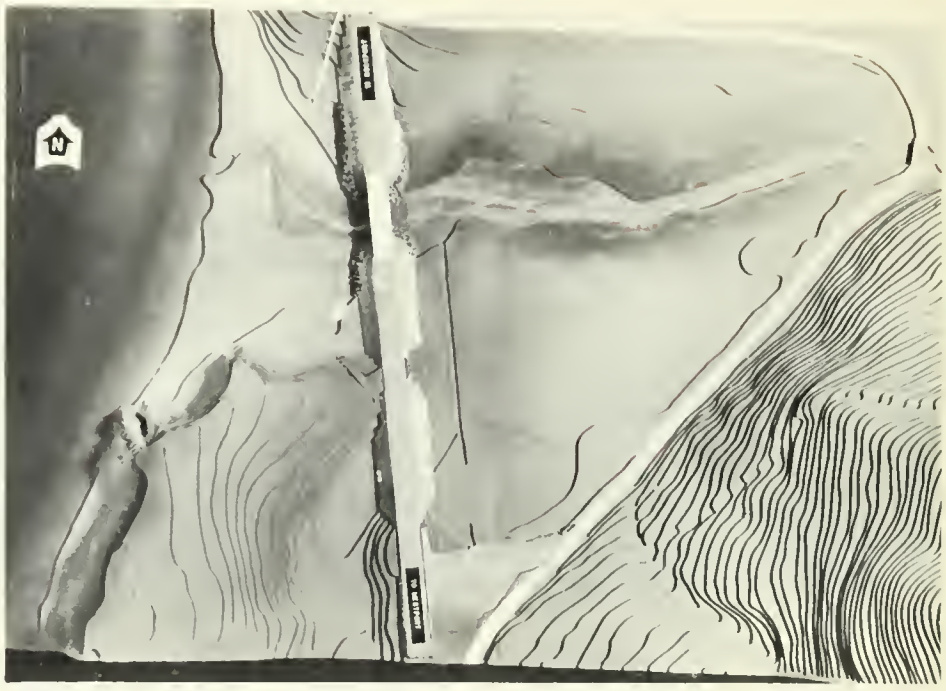
Prior to the 1961 decision in *Muskopf v. Corning Hospital District*, 55 Cal. 2d 211, the defense of sovereign immunity protected the state from liability in most cases involving governmental activities, including accidents caused by the planning, construction and maintenance of state highways. The *Muskopf* decision removed this defense but its effect was delayed for two years by the Legislature, i.e., actions against the state could not proceed to trial until on and after September 20, 1963.

As a result, the state has now had approximately three years of experience in operating under the legislation which was enacted in 1963. This legislation permits actions to be brought against the state under certain circumstances and subject to various defenses and immunities in the law. For the first year from September 20, 1963, to September 20, 1964, the state was covered by liability insurance. Thereafter, the state has been self-insured except for accidents arising from the operation of state vehicles which is still covered by insurance.

During this three-year period, the experience of the Department of Public Works, in general, has been good. The number of claims filed with the State Board of Control has increased considerably over prior years. For example, for the 1965–1966 fiscal year, a total of 510 claims were filed, which is more than 40 claims a month. The aggregate amount of the claims filed was $41,044,681. The board allowed 69 claims (approximately 14 percent of the total filed) in the aggregate amount of $76,091.

A substantial majority of the claims filed with the board terminate upon being denied. However, an increasing number of claimants whose claims are denied elect to proceed against the state in court. Some of these actions are favorably disposed of without trial on the basis of the defenses and immunities in the new law. On the other hand, a number of actions have been settled prior to trial where the state appeared to have liability. Of the 15 or 20 cases which have actually proceeded to trial, a judgment was rendered against the state in only one case to date.

The most important single case tried involved a suit by a number of property owners in Del Norte County for damages alleged to be in excess of one million dollars as a result of the December 1964 storm, one of the severest in California history. The entire town of Klamath was virtually destroyed and it was claimed that a partially completed new highway bridge and the old Bear Bridge, built in 1926, increased the property damage. After a lengthy trial, involving hundreds of exhibits and testimony by many lay and expert witnesses, the trial judge ruled that the state bridges did not cause any of the damage.



Sometimes, in difficult legal cases involving property and right-of-way, it is necessary to build scale models to show the problem.

•Right of Way

Community Values

"Attitudes Toward Transportation: Their Nature and Effect" is the title of a current sociological research project which, it is hoped, will help the Right of Way Department more accurately identify the values held important by a community. The study, being conducted under contract by a psychological research organization, deals with underlying basic attitudes held by representative segments of a community rather than with their opinions, which have been found to be notoriously changeable. The results will be used in studies which lead to the selection of new highway routes by the California Highway Commission and will give the Division of Highways' planning staff one more important device by which to measure the potential public acceptance of their transportation solutions prior to the point of final decision.

Community Benefits

A second study, being conducted under contract by a real estate research firm, is expected to assist the Right of Way Department in the decisions which must be made regarding the potential multiple uses of right-of-way airspace. Social and economic factors, in addition to engineering and technical considerations, weigh heavily in selection of sites for airspace development and the study will bring together the components which will enable maximum benefits to the community, as well as to the motorist, to be realized.

Beautification

Divisionwide training courses in aesthetics, as related to highway design and construction, were held during the year and Right of Way agents were members of participating interdisciplinary teams. The courses served as background for the beginning of work on beautification programs which will be implemented during 1966–67. The selection and purchase of scenic easement strips adjacent to state highways in the federal-aid interstate and primary systems are among new responsibilities which will be assumed. Purchase of strips to allow screening of junkyards or purchase of the junkyards themselves, in case screening is not possible, is another new beautification responsibility. A study was also started to examine the problem of justly compensating signboard owners and landowners, who would be affected, in anticipation of state conforming legislation which will be considered in 1967.

Family, Business and Farm Relocotian Assistonce

At the beginning of the fiscal year the State Legislature authorized the Division of Highways to compensate, within limits, families, business and farm owners and tenants for costs incurred in moving their personal property when displaced by right-of-way clearance. The payments are in addition to relocation advice and assistance which has been provided for some years. Three thousand payments totaling $737,000 were made to displacees during this first year of operation of the program.

Program Accomplishment

Capital expenditures of $197,640,000 were made by the Right of Way Department during the year. The program increase over 1964–65 was 17 percent. Of this amount, $180,518,000 were spent for highway rights-of-way. During the year, 9,261 parcels of land were purchased including 303 by contested court action and 8,958 by negotiated settlement. The incidence of court actions, at 3.3 percent, is consistent with historic rates experienced under the long established policy of negotiations founded in equity for the public and affected owners.

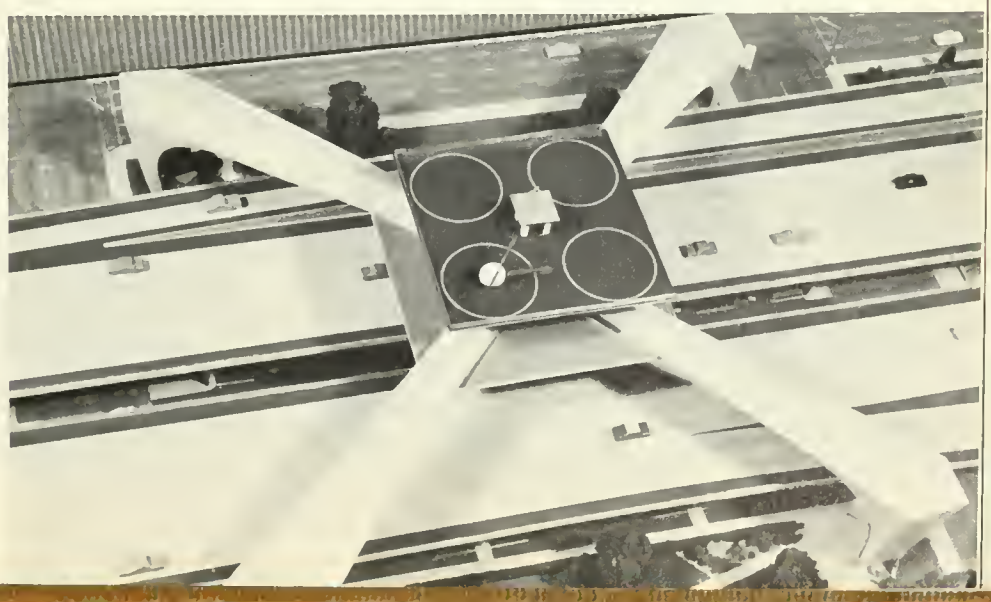
Obligations to relocate utility facilities outside highway rights-of-way amounted to $15,509,000 during the year and 858 separate agreements were entered with affected utility companies.

Also during the year $5,089,000 were returned to the State Highway Fund from the rental of 4,318 units during the interim period between right-of-way purchase and clearance for construction. Clearance (the sale of improvements) and sales of remainder parcels returned another $11,528,000 to the fund. These property management activities brought in a return sufficient to pay 80 percent of the total costs of operation of the Right of Way Department.

Other Programs

For the California Water Project 728 parcels valued at $10,727,000 were appraised and purchased and for other state agencies and non-right-of-way uses for the Division of Highways 193 parcels costing $1,441,000 were purchased by the Right of Way Department.

Below: Perhaps a little far out today, a freeway-spanning restaurant and heliport such as the one shown in this model may be a practical future method to conserve vital space in urban areas.



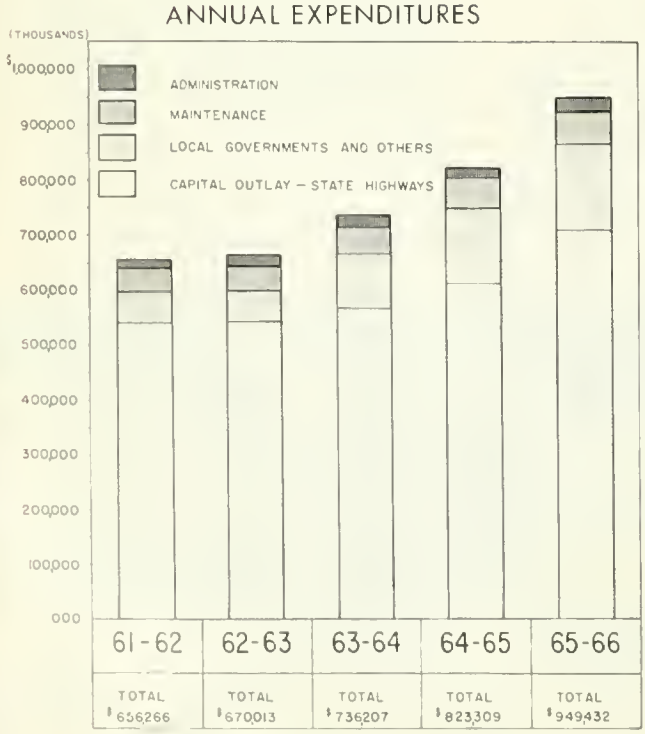
•Fiscal Management

Periodically the accounting officers from the various district offices are called in to Sacramento Headquarters for briefing and training in improved procedures. At front far left is Comptroller John Burrill, directly behind him Deputy Comptroller Andrew Schoellkopf.

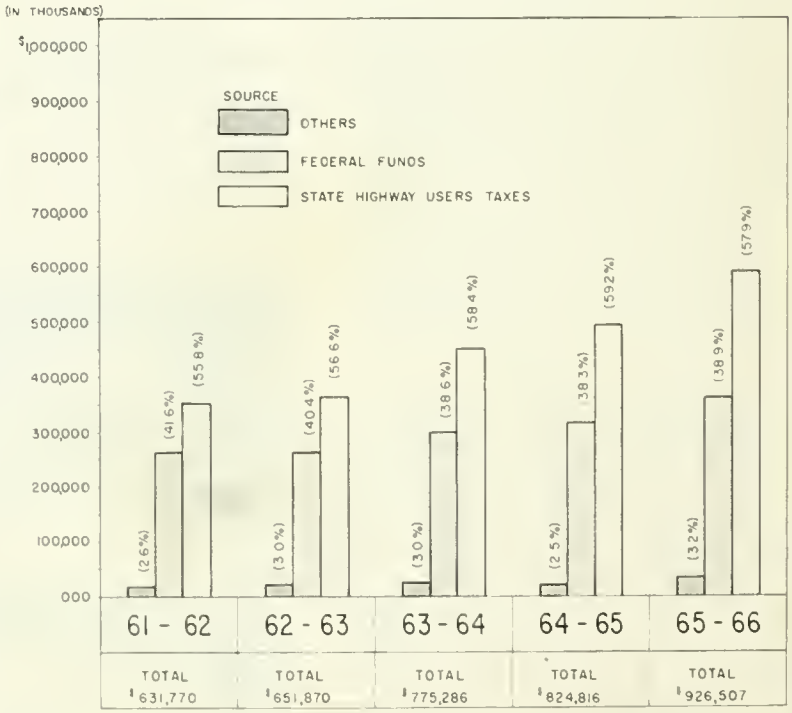
STATE HIGHWAY FUND

1961-62/1965-66

ANNUAL EXPENDITURES



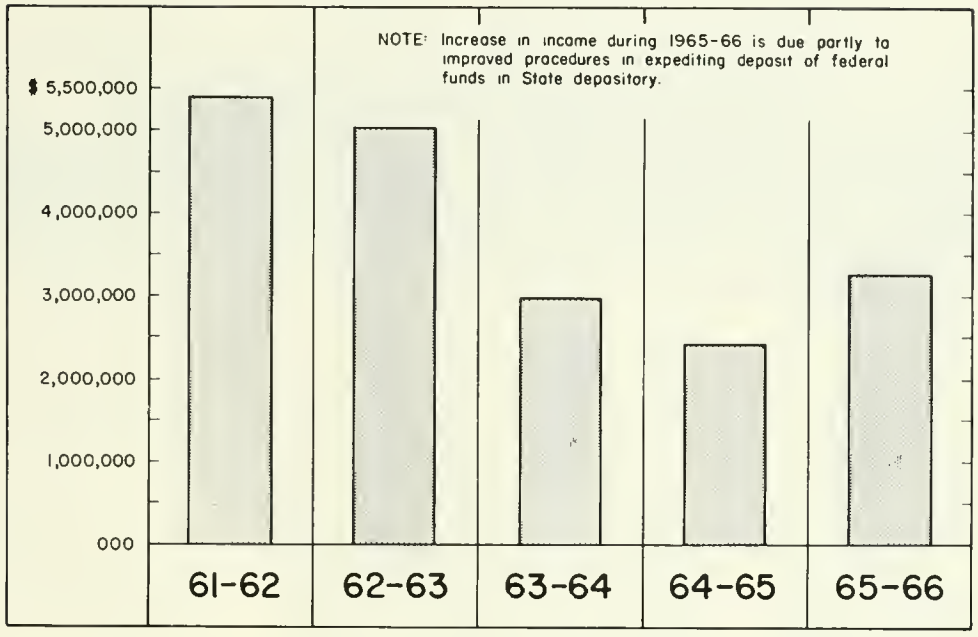
ANNUAL REVENUE COLLECTED



STATE HIGHWAY FUND

INTEREST EARNED ON TEMPORARY INVESTMENTS

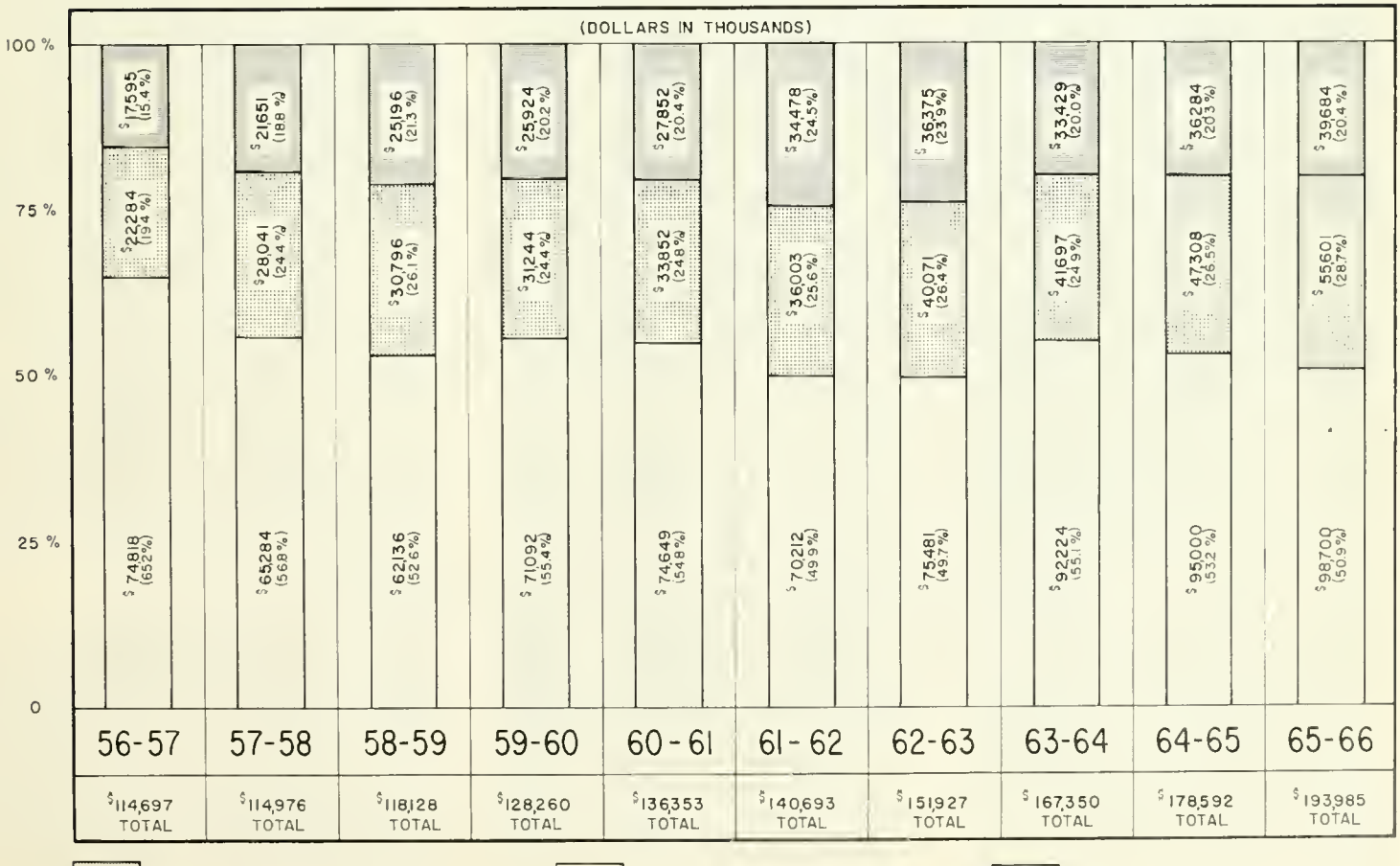
1961-62 1965-66



DIVISION OF HIGHWAYS

ANNUAL DISTRIBUTION OF MOTOR VEHICLE LICENCE FEES

1956-57 ——— 1965-66



1967-68 Highway Budget

The California Highway Commission budgeted $673,046,761 for state highway construction purposes, including rights-of-way and engineering, for the 1967–68 fiscal year.

The new budget contains $457,984,000 for major construction and improvement (including engineering); $190,421,961 for rights-of-way; plus other amounts for contingencies, resurfacing programs, signs and striping, highway planning studies and minor improvements.

A total of $4,000,000 has been earmarked in the new budget for traffic safety and operational improvement projects in the $5,000–$50,000 bracket, particularly at points of accident concentration. These range from easing curves, installing or modifying signals, constructing left-turn storage lanes, applying antiskid treatment to the road surface, providing truck climbing lanes, and many more.

State Highway Engineer J. C. Womack had told the commission that more costly and extensive projects for accident reduction, such as replacing narrow bridges, installing median barriers on freeways, and improving highway alignment through rugged terrain, as well as the most important measure of all for accident reduction, the replacing of conventional highways with access-controlled freeways, will be financed out of general construction funds.

Major construction effort in the new budget continues on California's 2,165-mile share of the national system of interstate and defense highways. The budget contains $386,483,000 in federal funds, of which $327,766,000 is included for the completion of this system, which by recent federal law must be accomplished by 1973.

As in previous years, the commission approved some projects which are only partly financed in the 1967–68 budget, but which under current federal and state procedures can be placed under contract in their entirety with the assurance that the balance will be included in the next fiscal year budget.

It also allocated $160,925,800 to finance the balance of projects which were approved in the 1966–67 budget.

In addition to the construction items, the commission budgeted $96,880,000 for state highway purposes other than construction, including $54,580,000 for maintenance; $19,920,000 for administration, including $500,000 for insurance and payment of tort claims and judgments; $8,660,000 for maintenance of landscaping, functional planting and safety roadside rests; $5,000,000 for buildings and land; $3,860,000 for highway research and development; $1,310,000 for honor camps; $3,500,000 for equipment; and $50,000 for legislative claims.

In submitting the budget to Governor Edmund G. Brown, Robert B. Bradford, chairman of the commission and Administrator of the Transportation Agency, cautioned against comparing it with the state highway budget for the current fiscal year.

"Such a comparison would be meaningless at this time," he said, "because the new budget includes for the first time accrual funds.

"This means that many millions of dollars, although in the state's pipeline, will not be received as cash in the State Highway Fund during the coming fiscal year."

Bradford said that the rate at which highway projects can be awarded by the Department of Public Works is dependent upon the rate at which cash actually is received in this fund.

Non-State-Highway Items

A third budget segment totaling $160,646,239 was allocated for functions not under state highway jurisdiction.

The largest non-state-highway items are $78,900,000 for construction and rights-of-way for streets and roads on the select system of cities and counties as established by the 1963 Legislature, and $55,000,000 for improvements and maintenance work on city streets.

The other such items are $8,512,739 in federal aid for county roads on the federal aid secondary system, and $4,200,000 in state funds to counties for use in matching these federal funds; $5,000,000 in state funds to help finance railroad grade separation projects on local streets and roads; $3,133,500 in state funds to pay part of the cost of extending federal aid secondary county roads into urban areas; $3,890,000 for maintenance of state-owned toll bridges; $1,500,000 in engineering funds for cities; and $190,000 for administration of the Outdoor Advertising Act.

The total estimated revenue from all state sources is $544,090,000. It will derive from $411,960,000 in gasoline taxes, $76,000,000 in motor vehicle fees, $33,540,000 in taxes on diesel fuel, $17,900,000 in taxes on for-hire vehicles, $4,000,000 in interest, $500,000 from leases, and $190,000 in outdoor advertising fees.

1967-68 State Highway Budget by Region, Counties

NOTE 1—The term "freeway" means a multilane divided highway with full access control, no crossings at grade, no stop lights and no left-turn movements. An "expressway" may have the same access control as the freeway but may permit left turns and crossings at grade at some intersections which may or may not be signalized. "Two-lane expressways" are two-lane highways with access control, and are usually planned for future expansion to four lanes.

NOTE 2—Projects which overlap county lines are listed in both counties.

NOTE 3—Construction contracts financed in this new budget may be awarded beginning January 1967; right-of-way funds may not be spent until July 1, 1967, the start of the fiscal year.

NOTE 4—Questions concerning individual items can best be answered by your Division of Highways district office.

SAN DIEGO AND IMPERIAL COUNTIES

Imperial County

Extend the four-lane Interstate 8 Freeway, now completed or under construction between 20 miles west and 10 miles east of the Imperial-San Diego county line, another 19.7 miles easterly to construction in progress between south of Seeley and El Centro. The project includes constructing interchanges at Route 98, Imperial Highway and Drew Road, and bridges across the South Fork of Coyote Wash and the Westside Main Canal. Estimated cost, $8,000,000, of which $3,850,000 will be budgeted in the 1968–69 fiscal year.

Construct a safety roadside rest for eastbound traffic south of the Interstate 8 Freeway at Sand Hills, east of El Centro, and revise the existing roadside rest in the median to serve westbound traffic. Estimated cost, $255,000.

Rights-of-way on various state highway routes—$712,000.

San Diego County

$9,400,000 to complete the financing for constructing the first unit of the Interstate 805 Freeway in San Diego between 0.2 mile north of Home Avenue and the Interstate 8 Freeway, a distance of 3.6 miles. The project includes constructing interchanges at Wabash Boulevard, University Avenue and El Cajon Boulevard, and a partial interchange at Madison Avenue. Estimated cost, $11,000,000, of which $1,600,000 had been budgeted in the 1966–67 fiscal year.

$6,781,000 to complete the financing for constructing an interchange between the eight-lane Interstate 5 and Interstate 8 Freeways and the four-lane Route 209 and future Route 109 Freeways, just west of Pacific Coast Highway (US 101) and south of the San Diego River in San Diego. The project includes constructing paired Interstate 5 Freeway bridges across the San Diego River and an interchange between Interstate 8 and Morena Boulevard. Estimated cost, $11,781,000, of which $5,000,000 had been budgeted in the 1966–67 fiscal year.

$3,587,000 to complete the financing for extending the eight-lane Interstate 5 Freeway, now under construction between Oceanside and south of San Clemente, another 8.9 miles northerly to 0.2 mile north of the San Diego-Orange county line, with an interchange at Basilone Road. This project, together with others completed, under construction or budgeted, will provide full freeway from San Ysidro near the Mexican border to northern Los Angeles County. Estimated cost, $8,587,000, of which $5,000,000 had been budgeted in the 1966–67 fiscal year.

$4,000,000 to complete the financing for constructing the eight-lane Interstate 5 Freeway between Tecolote Creek and 0.5 mile north of Balboa Avenue in San Diego. The project includes constructing interchanges at Claremont Boulevard and Balboa Avenue and extending Claremont Boulevard easterly to Morena Boulevard. Estimated cost, $5,490,000, of which the state will pay $5,000,000 ($1,000,000 had been budgeted in the 1966–67 fiscal year) and the city the balance.

Landscape the Interstate 5 Freeway between 0.2 mile south of Palm Street and Old Town Viaduct in San Diego, a distance of 2.2 miles, and landscape and tree and functional planting on an additional 12.4 miles between 0.4 mile north of Balboa Avenue and Via de la Lalle near Del Mar. Estimated cost, $1,308,000.

$5,000,000 to complete the financing for extending the four-lane Interstate 8 Freeway 5.6 miles easterly to 2.5 miles east of Alpine, and constructing interchanges at Tavern Road and the west junction of Willows Road. Estimated cost, $7,000,000, of which $2,000,000 had been budgeted in the 1966–67 fiscal year.

Extend the previously budgeted four-lane Interstate 8 Freeway 3.5 miles easterly to six miles east of Alpine, with an interchange at the east junction of Willows Road. Estimated cost, $3,000,000.

Widen Fairmount Avenue Bridge and portions of the ramps and weaving lanes of the Interstate 8 Freeway at the Fairmount Avenue Interchange in San Diego. Estimated cost, $310,000.

Extend the four-lane US 395 Freeway 4.4 miles northerly to 0.4 mile north of the south city limit of Escondido. The project includes constructing interchanges at Pomerado Road-Highland Valley Road and at Sunset Drive-Felicita Road, a bridge across Lake Hodges, and a map inspection stop just south of Green Valley Creek. Estimated cost, $3,700,000.

Construct an interchange on the US 395 Expressway with Kearney Villa Road near Camp Elliott to provide traffic movement to Murphy Canyon Road (Route 103). Murphy Canyon Road eventually will be extended to US 395. Estimated cost, $495,000.

Widen and realign 1.3 miles of Route 94 near Three Springs Ranch, approximately four miles southeast of Potrero. Estimated cost, $220,000.

Reconstruct portions of the shoulders of Route 67 between 3.4 miles south of Ramona and Route 78 at Ramona, and on Route 78 from this point to Route 79 at Santa Ysabel, a total distance of 12 miles. The project includes widening a bridge on Route 78 across Hatfield Creek, approximately 2.5 miles east of Ramona. Estimated cost, $200,000.

Grade and pave to reconstruct and widen Friars Road and Friars Road Extension (Federal Aid Secondary Route 731) as an urban extension project between US 395 in San Diego and Mission Gorge Road, 2.7 miles easterly, to serve the multipurpose stadium now under construction. After widening the existing two-lane facility, the road will carry four lanes of traffic under normal circumstances, but can carry eight lanes with varying numbers of lanes for peak directional flow during stadium activities. Estimated cost, $2,060,000, of which the state will pay $1,000,000, and the city and county the balance.

Rights-of-way on various state highway routes—$19,456,000.

RIVERSIDE AND SAN BERNARDINO COUNTIES

Riverside County

$3,666,000 to complete the financing for extending the 24-mile four-lane Interstate 10 Freeway east of Indio another 20.6 miles to construction in progress between east of Desert Center and 18 miles west of Blythe. This budgeted project includes constructing a pair of safety roadside rests at Cactus City and interchanges at Eagle Mountain and Rice Roads. Estimated cost, $7,041,000, of which the state will pay $6,766,000 ($3,100,000 of which had been budgeted in the 1966–67 fiscal year) and the Kaiser Railroad the balance as its share of the cost of constructing a freeway crossing of its tracks.

Install facilities at the eastbound and westbound safety rest areas on the Interstate 10 Freeway at Cactus City. Estimated cost, $135,000.

Tree and functional planting on the Interstate 10 Freeway between Redlands in San Bernardino County and Beaumont in Riverside County, a distance of approximately 11.8 miles. Estimated cost, $75,000. (Also listed in San Bernardino County.)

Convert US 395 from a two- to a four-lane expressway by constructing new lanes for northbound traffic and using the existing facility for southbound, between one mile north of Temecula and 3.1 miles northerly, and on an additional 1.8 miles to about one mile south of Sun City. The project includes constructing bridges across Santa

Gertrudis and Warm Springs Creeks. Estimated cost, $1,120,000.

Widen Route 74 from two to four lanes between the west junction of Route 79 (Winchester Road) and 1.5 miles west of Hemet, a distance of 3.5 miles. Estimated cost, $310,000.

Replace and install culverts and improve channels at five locations on Route 71 between the San Bernardino county line and the junction of Route 79, approximately three miles north of the San Diego county line, and on Route 79 at Gilman Hot Springs, north of San Jacinto. Estimated cost, $106,000.

Rights-of-way on various state highway routes—$2,586,000.

San Bernardino County

$18,900,000 to complete the financing for constructing the eight-lane Interstate 15 Freeway on new alignment between Devore and Route 138 at Cajon, a distance of 10.3 miles. The project includes constructing an interchange with the future Route 31 Freeway (Devore Cutoff) and the first unit of 1.8 miles of this freeway southerly from the interchange. Estimated cost, $23,900,000, of which $5,000,000 had been budgeted in the 1966–67 fiscal year.

$1,810,000 to complete the financing for constructing the four-lane Interstate 40 Freeway between 2.5 miles east of Daggett and 11 miles east of Newberry, a distance of 20.8 miles, with interchanges at Airport Road, the existing highway at Newberry, and Fort Cady Road, and seven bridges across washes. Estimated cost $7,810,000, of which $6,000,000 had been budgeted in the 1966–67 fiscal year.

$1,250,000 to complete the financing for constructing a connecting four-lane freeway between Interstate 15 near Base Line Street in San Bernardino and Route 30, and a six-lane freeway on Route 30 between this point and Waterman Avenue (new Route 18), a distance of 2.4 miles, and for constructing Waterman Avenue as a four-lane conventional highway between 40th Street and the north city limit, a distance of 0.9 mile. The freeway construction includes interchanges at Interstate 15, Highland Avenue, E Street and Waterman Avenue, and the installation of traffic signals and channelization on Waterman Avenue between Route 30 and the north city limit. Estimated cost, $6,960,000, of which $5,710,000 had been budgeted in the 1966–67 fiscal year.

Relocate Route 138 between 5.4 miles north of Crestline and 5.2 miles northwesterly as a two-lane expressway, and grade an additional two lanes for an eventual four-lane expressway as the existing highway will be inundated by the construction of the Cedar Springs Reservoir. Estimated cost, $2,500,000, of which state highway funds will finance $600,000, and the Department of Water Resources the balance.

Construct a bridge across Sheep Creek and two dikes on Route 138 near Desert Springs, about 3.5 miles east of the Los Angeles county line, and improve drainage on this route between 2.4 miles east of Route 2 and 1.7 miles west of Interstate 15, northwest of Cajon. Estimated cost, $450,000.

Improve drainage, make spot improvements, and construct a bridge across Hathaway Creek on Route 38, between six miles south and ten miles east of Camp Angeles. The project includes realigning 0.3 mile of this highway just west of Forest Home Boulevard to ease a curve. Estimated cost, $282,000.

Widen portions of Route 62 (Twentynine Palms Highway) to four lanes between Twentynine Palms and four miles westerly. Estimated cost, $100,000.

Improve drainage at 24 locations on Route 18 between four miles south of Crestline and east of Big Bear Lake, and at one location on Route 38 at its junction with Route 18 north of Big Bear City. Estimated cost, $85,000.

Tree and functional planting on the Interstate 10 Freeway between Redlands in San Bernardino County and Beaumont in Riverside County, a distance of approximately 11.8 miles. Estimated cost, $75,000. (Also listed in Riverside County.)

Rights-of-way on various state highway routes—$2,890,000.

LOS ANGELES REGION

Los Angeles County

Extend the eight-lane Interstate 5 Freeway construction in progress at the summit of the Five Mile Grade 5.8 miles southerly to a previously budgeted section extending to the completed freeway at Castaic Creek, south of Castaic. The project includes constructing an interchange at Violin Canyon Road, two interchanges with the existing Route 5 Expressway, and widening the bridge across Palomas Wash. Estimated cost, $12,500,000, of which $5,500,000 will be budgeted in the 1968–69 fiscal year.

$1,800,000 to complete the financing for extending the above eight-lane Interstate 5 Freeway project 4.1 miles southerly to Castaic Creek, south of Castaic, with interchanges at Parker Road, Hasley Canyon Road, and a bridge across Castaic Creek. Estimated cost, $5,400,000, of which $3,600,000 had been budgeted in the 1966–67 fiscal year.

Construct 2.8 miles of the eight-lane Interstate 210 Freeway between the west bank of the San Gabriel River in Irwindale and 0.3 mile east of Azusa Avenue (Route 39) in Azusa. The project includes constructing a bridge across the river, and interchanges at Irwindale, Vernon and Azusa Avenues. Estimated cost, $8,810,000, of which $3,410,000 will be budgeted in the 1968 69 fiscal year.

$4,450,000 to complete the financing for constructing the eight-lane Interstate 210 (Foothill) Freeway between Santa Anita Avenue in Arcadia and Highland Avenue in Duarte, a distance of four miles. The project includes constructing interchanges at Santa Anita Avenue, Huntington Drive, Myrtle Avenue, Mountain Avenue and Buena Vista Street. Estimated cost, $13,450,000, of which $9,000,000 had been budgeted in the 1966–67 fiscal year.

Construct the eight-lane Route 60 (Pomona) Freeway between 0.4-mile west of Old Brea Canyon Road in Industry and 0.2 mile east of the northeast junction of the Route 57 Freeway, a distance of three miles, with interchanges at Old Brea Canyon Road, Grand Avenue and Diamond Bar Boulevard. Estimated cost, $6,900,000, of which $2,500,000 will be budgeted in the 1968–69 fiscal year.

Construct a pedestrian overcrossing on the Route 60 (Pomona) Freeway at Cogswell Road in South El Monte. Estimated cost, $80,000.

Construct Mulholland Drive (Route 268) as a four-lane scenic highway between Topanga Canyon Boulevard (Route 27) and Sepulveda Boulevard (Route 1), a distance of 8.9 miles. Estimated cost, $8,300,000, of which the state will pay $5,810,000 ($2,000,000 in the 1966-67 fiscal year) and the city the balance.

$5,210,000 to complete the financing for extending the Route 134 Freeway 2.9 miles easterly to the east city limit of Glendale, and for constructing 0.2 mile of embankment easterly from this point for future freeway construction. The project includes constructing interchanges at San Fernando Road, Pacific Avenue, Central Brand Avenue and Glendale Avenue, and portions of the interchange with the future Route 2 Freeway. Estimated cost, $11,350,000, of which the state will pay $11,210,000 ($6,000,000 was budgeted in the 1966-67 fiscal year) and the Los Angeles County Flood Control District the balance.

Extend the previously budgeted eight-lane Route 91 Freeway 1.7 miles easterly from Artesia Boulevard in Dairy Valley, Los Angeles County, to 0.2 mile west of Valley View Street in Buena Park, Orange County. The project includes construction of interchanges at 183rd Street-Carmenita Avenue and Walker Street, and a partial interchange at Orangethorpe Avenue. Estimated cost, $5,200,000, of which $1,000,000 will be budgeted in the 1968–69 fiscal year. (Also listed in Orange County.)

$4,000,000 to complete the financing for constructing the eight-lane Route 91 Freeway between 0.3 mile west of Lakewood Boulevard (Route 19) in Bellflower and 0.1 mile east of the Interstate 605 Freeway in Dairy Valley, a distance of 2.7 miles. The project includes constructing interchanges at Bellflower Boulevard, Clark Avenue and Lakewood Boulevard. Estimated cost, $8,000,000, of which $4,000,000 had been budgeted in the 1966–67 fiscal year.

Modify traffic signals on Artesia Boulevard (Route 91) at nine intersections between Aviation Boulevard-Pier Avenue, at the border between Manhattan Beach and Redondo Beach, and Hawthorne Boulevard separating Redondo Beach and Torrance. Estimated cost, $200,000, of which the state will pay $125,000 and the Cities of Redondo Beach, Manhattan Beach and Lawndale the balance.

Complete the eight-lane Hollywood Freeway (Routes 101 and 170) by extending a previously financed section 2.2 miles northerly from 0.1 mile north of Sherman Way to the Golden State Freeway (Interstate 5) in Los Angeles. The project includes construction of an interchange at Roscoe Boulevard and a partial interchange at Arleta Avenue-Sheldon Street. Estimated cost, $4,300,000.

Grade portions and install drainage structures for the future four- and six-lane Antelope Valley Freeway (Route 14) between San Fernando Road and just north of the Santa Clara River, a distance of about six miles, southeast of Newhall, and widen the existing route (Sierra Highway) from three and four lanes to four lanes divided on improved alignment with left-turn lanes, between San Fernando Road and 0.2 mile north of Placerita Canyon Road, a distance of about 1.6 miles. Estimated cost, $3,300,000.

Extend the widening described in the above project on existing Route 14 (Sierra Highway) another 1.5 miles northeasterly, connecting to a previously financed widening project for the 1.9 miles between Friendly Valley Road and Solemint. Estimated cost, $400,000, of which the state will pay $150,000, and the county the balance.

Landscape the Santa Monica Freeway (Interstate 10) between Lincoln Boulevard in Santa Monica and Sawtelle Boulevard in Los Angeles, and the Route 1 Freeway between the Santa Monica Freeway and Fourth Street in Santa Monica, a total distance of 3.7 miles. Estimated cost, $500,000.

Reconstruct the westbound lanes of the San Bernardino Freeway (Interstate 10) on improved alignment to ease a curve between 0.3 mile and 0.7 mile west of Atlantic Boulevard in Alhambra. Estimated cost, $470,000.

Install a median barrier at various locations on the Santa Ana (Interstate 5), Pasadena (Route 11), Hollywood (US 101) and Ventura (US 101) Freeways in and near Los Angeles. Estimated cost, $500,000.

Install a median barrier on the Interstate 405 (San Diego) Freeway between 0.4 mile southeast of the Los Angeles county line and Harbor Boulevard in Costa Mesa, and on the Interstate 605 (San Gabriel River) Freeway between the Interstate 405 Freeway in Orange County and 183rd Street in Dairy Valley, Los Angeles County, a total distance of 18.3 miles. Estimated cost, $410,000. (Also listed in Orange County.)

Landscape the San Diego Freeway (Interstate 405) between Alameda Street and the Los Angeles River near Long Beach, and the Long Beach Freeway (Route 7) through the area of the interchange between the two freeways. Estimated cost, $480,000.

Widen the truck scales and improve drainage on the San Diego Freeway (Interstate 405) between 0.2 mile south of Avalon Boulevard and Main Street, east of Torrance. Estimated cost, $130,000.

Landscape the Interstate 605 (San Gabriel River) Freeway between Cecelia Street in Downey and Whittier Boulevard in Whittier, and the Interstate 5 (Santa Ana) Freeway through the area of the interchange between the two freeways and at the Shoemaker Avenue Overcrossing in Norwalk. Estimated cost, $720,000.

Widen Western Avenue (Route 213) to four lanes divided between Palo Verdes Drive near Lomita and Redondela Drive, 0.8 mile southerly. Estimated cost, $310,000, of which the state will pay $155,000, and the county the balance.

Widen Lincoln Boulevard (Route 1) and improve drainage between 83rd Street in Los Angeles and 0.5 mile northerly. Estimated cost, $265,000, of which the state will pay $140,000, and the city the balance.

Modify traffic signals and highway lighting and install left-turn lanes at 17 intersections on Santa Monica Boulevard (Route 2) between Centinela Avenue and Moreno Drive in Los Angeles. Estimated cost, $170,000 of which the state will pay $100,000, and the city the balance.

Widen Alvarado Street (Route 2) at the Hollywood Freeway (US 101) and modify traffic signals and highway lighting at that location and at the intersections of Alvarado Street with Kent Street, Montana Street and Glendale Boulevard in Los Angeles. Estimated cost, $110,000, of which the state will pay $80,000, and the city the balance.

Modify traffic signals and construct left-turn lanes on Foothill Boulevard in Claremont between Towne Avenue and Indian Hill Boulevard. Estimated cost, $135,000, of which the state will pay $75,000, and the city the balance.

Grade and pave to reconstruct and widen South Street (Federal Aid Secondary Route 737) from two to four lanes as an urban extension project between the San Gabriel River in Artesia and Carmentia Avenue in Dairy Valley, a distance of 3.3 miles. Estimated cost, $1,230,000, of which the State will pay $615,000; Dairy Valley, $499,000; and Artesia, $116,000.

Rights-of-way on various state highway routes—$60,553,000.

Orange County

Extend the Interstate 405 (San Diego) Freeway from 0.2 mile northwest of Jamboree Road, northeast of the Orange County Airport, southeasterly to the Interstate 5 (Santa Ana) Freeway, a distance of 6.6 miles, and construct the four-lane Route 133 (Laguna Canyon Road) Freeway 1.6 miles southerly from the Interstate 5 Interchange to 0.2 mile north of Laguna Canyon Road. The Interstate 405 Freeway will have eight lanes southeasterly to Route 133 and six lanes to Interstate 5. The project includes constructing interchanges at Jamboree Road, Culver Drive, Jeffrey Road, the Route 133 Freeway, Valencia Avenue, and the Interstate 5 Freeway, and bridges across San Diego Creek Channel and San Diego Creek. Estimated cost $12,500,000, of which $5,500,000 will be budgeted in the 1968–69 fiscal year. Completing the sections under construction or previously budgeted at the western end of this project will complete the Interstate 405 Freeway in its entirety as a bypass west and south of the Los Angeles metropolitan area between Interstate 5 in the San Fernando Valley and Interstate 5 northwest of El Toro.

$1,100,000 to complete the financing for extending the eight-lane Interstate 405 (San Diego) Freeway 2.2 miles southeasterly from Harbor Boulevard in Costa Mesa to Bristol Street. The project includes constructing interchanges at Fairview Road and Bristol Street. Estimated cost, $5,600,000, of which $4,500,000 had been budgeted in the 1966–67 fiscal year.

Landscape the Interstate 405 (San Diego) Freeway between 0.5 mile east of Bolsa Chica Road and Beach Boulevard (Route 39) in Westminster, a distance of 3.5 miles. Estimated cost, $520,000.

Landscape the Interstate 405 (San Diego) Freeway between 0.4 mile west of Los Alamitos Boulevard at the north city limit of Seal Beach and 0.5 mile east of Bolsa Chica Road in Westminster, a distance of three miles, and the Route 22 (Garden Grove) Freeway between Interstate 405 and 0.7 mile easterly, also at the north city limit of Seal Beach. The project includes constructing a landscape maintenance building on the south side of Interstate 405 at Bolsa Chica Road. Estimated cost, $450,000.

Install a median barrier on the Interstate 405 (San Diego) Freeway between 0.4 mile southeast of the Los Angeles county line and Harbor Boulevard in Costa Mesa, and on the Interstate 605 (San Gabriel River) Freeway between the Interstate 405 Freeway in Orange County and 183rd Street in Dairy Valley, Los Angeles County, a total distance of 18.3 miles. Estimated cost, $410,000. (Also listed in Los Angeles County.)

Construct the eight-lane Route 91 (Artesia) Freeway between 0.4 mile west of Valley View Street in Buena Park and 0.4 mile east of the Interstate 5 (Santa Ana) Freeway in Fullerton, a distance of three miles. The project includes constructing interchanges at Knott Avenue and Beach Boulevard (Route 39), and portions of the interchange with Interstate 5. Estimated cost, $10,000,000.

Extend the previously budgeted eight-lane Route 91 Freeway 1.7 miles easterly from Artesia Boulevard in Dairy Valley, Los Angeles County, to 0.2 mile west of Valley View Street in Buena Park, Orange County. The project includes construction of interchanges at 183rd Street-Carmenita Avenue and Walker Street, and a partial interchange at Orangethorpe Avenue. Estimated cost, $5,200,000 of which $1,000,000 will be budgeted in the 1968–69 fiscal year. (Also listed in Los Angeles County.)

Pave the median, install a median barrier, and modify signing and lighting on the Route 91 (Riverside) Freeway between the Interstate 5 (Santa Ana) Freeway and Lemon Street at the west city limit of Anaheim, and install headlight glare shields from this point to the Route 55 (Newport) Freeway in Anaheim. Estimated cost, $400,000.

$7,216,000 to complete the financing for widening the Interstate 5 Freeway from four to eight lanes between Route 1 south of San Juan Capistrano and the Interstate 405 (San Diego) Freeway northwest of El Toro, and to six lanes from this point northwesterly to the Route 133 (Laguna Canyon Road) Freeway, a distance of 16.4 miles. Estimated cost, $12,716,000, of which $5,500,000 had been budgeted in the 1966–67 fiscal year.

Construct the eight-lane Route 57 (Orange) Freeway from Orangethorpe Avenue in Placentia to 0.1 mile north of Nutwood Avenue in Fullerton, a distance of 1.4 miles. Estimated cost, $5,050,000.

Widen Pacific Coast Highway (Route 1) between one mile north of 23rd Street in Huntington Beach and Warner Avenue, 2.8 miles northerly, and install channelization. Estimated cost, $420,000.

Widen Beach Boulevard (Route 39) and install traffic signals, highway lighting and

channelization between Yorktown Street in Huntington Beach and Heil Avenue in Westminster, a distance of three miles. Estimated cost, $216,000, of which the state will pay $120,000, and the two cities the balance.

Reconstruct portions and resurface Beach Boulevard (Route 39) and install traffic signals and highway lighting between Ninth Street and Grand Avenue in Buena Park, a distance of one mile. Estimated cost, $325,000, of which the state will pay $285,000, and the city the balance.

Landscape the Route 55 (Newport) Freeway at the Fairhaven and Laveta Avenue overcrossings, and the Route 22 (Garden Grove) Freeway at Meats Avenue in Orange. Estimated cost, $60,000.

Grade and pave to reconstruct and widen Katella Avenue (Federal Aid Secondary Route 826) in Los Alamitos from two to four lanes as an urban extension project between Lexington Avenue and the east city limit, a distance of one mile. Estimated cost, $109,000, to be shared equally by the state and city.

Rights-of-way on various state highway routes—$5,185,000.

CENTRAL COASTAL COUNTIES PROJECTS

Monterey County

$3,250,000 to complete the financing for constructing a four-lane freeway on Route 1 between Viejo Road at the south city limit of Monterey and Fort Ord, a distance of 6.7 miles, with interchanges at Munras Avenue, Aguajito Road, Route 68, Casa Verde Avenue, Del Monte Avenue, Humboldt Street and Fremont Street. Estimated cost, $10,650,000, of which $7,400,000 had been budgeted in the 1966–67 fiscal year.

Replace the existing narrow timber bridge across Pfeiffer Canyon on Route 1, about 1.1 miles south of Big Sur, with a wider concrete structure, and reconstruct approaches. Estimated cost, $370,000.

Extend Humboldt Street from Roberts Avenue to Del Monte Avenue at Canyon Del Rey Road in Seaside to provide traffic service from Del Monte Avenue to the Route 1 Freeway, now under construction through that city. The project includes a crossing at grade of the Southern Pacific Company's tracks. Estimated cost, $100,000.

$1,750,000 to complete the financing for constructing a four-lane freeway on US 101 between one mile south of King City and one mile north of the Salinas River, a distance of 3.1 miles, as a bypass of King City. The project includes constructing interchanges at First Street, Canal Street, Broadway and Jolon Road, and replacing a narrow steel bridge carrying southbound traffic across the Salinas River with a wider concrete structure. Estimated cost, $4,250,000, of which $2,500,000 had been budgeted in the 1966-67 fiscal year.

Tree and functional planting on the Route 68 Freeway between 0.5-mile south of Reservation Road and 0.2 mile north of Foster Road near Salinas, a distance of 2.3 miles. Estimated cost, $60,000.

Rights-of-way on various state highway routes—$1,186,000.

San Benito County

Rights-of-way on various state highway routes—$243,000.

San Luis Obispo County

Construct portions of four-lane US 101 on improved alignment between 2.5 miles north of San Luis Obispo and two miles northerly to ease seven curves. Estimated cost, $1,200,000.

Rights-of-way on various state highway routes—$400,000.

Santa Barbara County

Construct an interchange on US 101 and an overhead across the Southern Pacific Company's tracks at Los Carneros Road, about seven miles west of Santa Barbara. Estimated cost, $1,050,000, of which the state will pay $630,000, and the county the balance.

Convert the four-lane US 101 Expressway to a six-lane freeway between 0.5 mile south of the Ventura county line and 0.7 mile north of Route 150 in Santa Barbara County, a distance of 1.3 miles. The project includes constructing an interchange with Route 150 and an overhead across the relocated Southern Pacific Company's tracks. Estimated cost, $6,880,000, of which $2,600,000 will be budgeted in the 1968–69 fiscal year. (Also listed in Ventura County.)

Grade and pave to reconstruct and widen Hollister Avenue (Federal Aid Secondary Route 1181) in Santa Barbara from two to four lanes as an urban extension project between La Patera Lane and 0.1 mile west of Fairview Avenue, a distance of 0.6 mile. Estimated cost, $176,000, of which the state will pay $83,000 and the city the balance.

Rights-of-way on various state highway routes—$2,230,000.

Ventura County

Construct the four-lane Route 23 Freeway between Hillcrest Drive in Thousand Oaks and Tierra Rejada Road, 6.7 miles northerly, with interchanges at Hillcrest Drive, Janss Road, Avenue de Las Arboles, Olsen Road, McCrea Road and Tierra Rejada Road. Estimated cost, $10,000,000, of which $5,485,000 will be budgeted in the 1968–69 fiscal year.

Convert the four-lane US 101 Expressway to a six-lane freeway between 0.5 mile south of the Ventura county line and 0.7 mile north of Route 150 in Santa Barbara County, a distance of 1.3 miles. The project includes constructing an interchange with Route 150 and an overhead across the relocated Southern Pacific Company's tracks. Estimated cost, $6,880,000, of which $2,600,000 will be budgeted in the 1968–69 fiscal year. (Also listed in Santa Barbara County.)

Construct a weighing facility for eastbound trucks on the Ventura Freeway (US 101) near Las Posas Road, west of Camarillo. Estimated cost, $300,000.

Extend the six-lane Route 118 Freeway (now under construction through Santa Susana Pass to Kuehner Drive in Simi Valley) another 3.3 miles westerly to Tapo Canyon Road. The project includes completing the interchange at Kuehner Drive and constructing interchanges at Stearns Street, Yosemite Street and Tapo Canyon Road. Estimated cost, $5,600,000, of which $2,600,000 will be budgeted in the 1968–69 fiscal year.

$1,100,000 to complete the financing for extending the four-lane Route 33 Freeway another 3.2 miles northerly to 0.4 mile north of Casitas Vista Road with interchanges at Canada Larga and Casitas Vista Road and an overhead across the Southern Pacific Company's tracks north of Ventura. Estimated cost, $4,800,000, of which $3,700,000 had been budgeted in the 1966–67 fiscal year.

Widen Vineyard Avenue (Route 232) from two to four lanes between Central Avenue, north of Oxnard, and 0.6 mile northerly. Estimated cost, $200,000.

Install traffic signals, highway lighting and channelization on East Fifth Street (Route 34) between Rose Avenue, at the east city limit of Oxnard, and Las Posas Road, south of Camarillo. Estimated cost, $130,000 of which the state will pay $100,000 and the county the balance.

Rights-of-way on various state highway routes—$5,853,000.

SAN FRANCISCO BAY REGION

Alameda County

$10,974,000 to complete the financing for constructing the eight-lane Route 24 (Grove-Shafter) Freeway in Oakland between south of 27th Street and north of 51st Street, a distance of 1.8 miles. The project includes constructing interchanges at 27th Street, Interstate 580, Grove Street and 52nd Street, and provision in the median for trains of the Bay Area Rapid Transit District. Estimated cost, $23,131,764, of which $5,875,000 in state highway funds had been budgeted in the 1966–67 fiscal year, $6,245,902 will be contributed by the Bay Area Rapid Transit District, and $36,862 will be paid by the Alameda County Flood Control and Water Conservation District.

Extend eight-lane construction in progress on the Route 24 (Grove-Shafter) Freeway another 1.9 miles easterly to 0.2 mile east of Golden Gate Avenue in Oakland. The project includes constructing interchanges at Telegraph Avenue-Claremont Avenue and at Patton Street, and provision in the median for trains of the Bay Area Rapid Transit District. Estimated cost, $16,000,000, of which the state will pay $9,700,000 ($4,700,000 of which will be budgeted in the 1968-69 fiscal year) and the Bay Area Rapid Transit District the balance.

Landscape portions of the Route 24 Free-

way between 0.5 mile east of the Warren Boulevard Freeway (Route 13) in Oakland, Alameda County, and 0.4 mile west of the Orinda Interchange in Orinda, Contra Costa County, a distance of 2.4 miles. Estimated cost, $179,000. (Also listed in Contra Costa County.)

$9,700,000 to complete the financing for extending the eight-lane Interstate 580 Freeway from construction in progress (at the interchange of Interstate Routes 580 and 205 west of the San Joaquin county line) through Altamont Pass to 0.5 mile east of Vasco Road near Livermore, a distance of 8.5 miles. The project includes constructing interchanges at Grant Line Road, North Flynn Road and Greenville Road. It also involves grading for a roadside rest at the Grant Line Road Interchange, and constructing truck stop facilities at the North Flynn Road Interchange. Estimated cost, $14,700,000, of which $5,000,000 had been budgeted in the 1966–67 fiscal year.

Reconstruct and resurface portions of MacArthur Boulevard (Route 580) between Joaquin Avenue in San Leandro and Park Boulevard in Oakland prior to relinquishment to the two cities. MacArthur Boulevard has been superseded as a state highway by the construction of the Interstate 580 (MacArthur) Freeway. Estimated cost, $210,000.

Widen the Nimitz Freeway (Route 17) from four to six lanes between 0.1 mile north of Alvarado-Niles Road in Union City and 0.5 mile south of Tennyson Road in Hayward. The project includes constructing an interchange at Industrial Parkway and installing truck weighing facilities at that location. Estimated cost, $1,945,000, of which the state will pay $1,775,000, and Hayward the balance.

Reconstruct the base and resurface portions of Route 17 between Interstate 80 at the El Cerrito Overhead in Albany, Alameda County, and the Richmond-San Rafael Bridge in Richmond, Contra Costa County. Estimated cost, $400,000. (Also listed in Contra Costa County.)

Install a median barrier on six miles of the Interstate 80 Freeway between the El Cerrito Overhead in Albany, Alameda County, and County Road 20 in Contra Costa County. Estimated cost, $300,000. (Also listed in Contra Costa County.)

Resurface portions of Mission Boulevard (Route 185) between Jackson Street (Route 92) and Ashland Avenue in Hayward. Estimated cost, $125,000.

Grade and pave to reconstruct and widen Hesperian Boulevard (Federal Aid Secondary Route 1017) from two to six lanes as an urban extension project between Via Mercado and West Sunset Boulevard north of Hayward, a distance of 0.9 mile. Estimated cost, $600,000, to be shared equally by the state and county.

Rights-of-way on various state highway routes—$3,867,000.

Contra Costa County

Reconstruct the base and resurface portions of Route 17 between Interstate 80 at the El Cerrito Overhead in Albany, Alameda County, and the Richmond-San Rafael Bridge in Richmond, Contra Costa County. Estimated cost, $400,000. (Also listed in Alameda County.)

Install a median barrier on six miles of the Interstate 80 Freeway between the El Cerrito Overhead in Albany, Alameda County, and County Road 20 in Contra Costa County. Estimated cost, $300,000. (Also listed in Alameda County.)

Install lighting on the Interstate 80 Freeway bridges across Carquinez Strait and guard railing on the west bridge. Estimated cost, $258,000. (Also listed in Solano County.)

Tree and functional planting and construction of a landscape storage building on the Interstate 680 Freeway between one mile north of the Alameda county line and Sycamore Valley Road south of Danville, a distance of 5.5 miles. Estimated cost, $180,000.

Landscape portions of the Route 24 Freeway between 0.5 mile east of the Warren Boulevard Freeway (Route 13) in Oakland, Alameda County, and 0.4 mile west of the Orinda Interchange in Orinda, Contra Costa County, a distance of 2.4 miles. Estimated cost, $179,000. (Also listed in Alameda County.)

Rights-of-way on various state highway routes $1,228,000.

Marin County

Resurface portions of the six-lane US 101 Freeway between Corte Madera Creek and the San Rafael Viaduct in San Rafael, a distance of two miles. Estimated cost, $230,000.

Widen the US 101 Freeway by adding a southbound lane between the Golden Gate Bridge and 1.3 miles northerly. Estimated cost, $180,000.

Landscape the US 101 Freeway between 0.4 mile south and 0.8 mile north of Tamalpais Drive Interchange in Corte Madera. Estimated cost, $80,000.

Rights-of-way on various state highway routes—$1,306,000.

Napa County

Resurface and construct shoulders on Route 29 between Route 128 at Rutherford and 3.8 miles northwesterly. Estimated cost, $280,000.

Landscape the Route 29 Freeway between Napa Creek and 0.5 mile south of Trancas Street in Napa, a distance of 0.8 mile. Estimated cost, $90,000.

Reconstruct and widen Route 128 on improved alignment at two locations between 9.5 and 9.8 miles east of Route 29 near Rutherford. Estimated cost, $100,000.

Rights-of-way on various state highway routes—$295,000.

San Francisco County

$55,000 as the state's share of the cost of developing a park in the vicinity of the Clay and Washington Street ramps to the Embarcadero (Route 480) Freeway, based on the cost of landscaping these ramps.

Widen the Bayshore Freeway (US 101) from six to eight lanes between San Bruno Avenue near San Bruno and Third Street in San Francisco, a distance of 6.7 miles, and revise the directional signing. The project includes widening a bridge across Colma Creek, the Colma and Candlestick Road Undercrossings, and three overheads across railroad tracks. Estimated cost, $3,200,000. (Also listed in San Mateo County.)

Right-of-way on various state highway routes—$11,177,000.

San Mateo County

Construct 6.2 miles of the eight-lane Interstate 280 Freeway between 0.1 mile northeast of Woodside Road (Route 114) in Woodside, San Mateo County, and 0.5 mile south of Page Mill Road in Santa Clara County, linking sections completed, under construction or budgeted between Raymundo Drive in Woodside and Los Gatos-Santa Cruz Road (Route 17) in San Jose. The project includes construction of interchanges at Page Mill Road, Alpine Road and Sand Hill Road and bridges across Los Trancos and San Francisquito Creeks. Estimated cost, $9,600,000, of which $5,600,000 will be budgeted in the 1968–69 fiscal year. (Also listed in Santa Clara County.)

$3,675,000 to complete the financing for constructing 5.7 miles of the Interstate 280 Freeway connecting the freeway bridge across San Mateo Creek, now under construction, with construction in progress between Larkspur Drive in Millbrae and San Bruno Avenue in San Bruno. The project includes constructing a temporary connection between the bridge and Skyline Boulevard (Route 35) at Bunker Hill Drive, and interchanges at Hayne Road, Trousdale Drive, Millbrae Avenue-Hillcrest Boulevard, and Larkspur Drive, and a safety roadside rest for northbound traffic just north of the bridge. Estimated cost, $8,575,000, of which $4,900,000 had been budgeted in the 1966–67 fiscal year.

$1,760,000 to complete the financing for constructing 2.5 miles of the eight-lane Interstate 280 Freeway between 0.1 mile south of Woodside Road (Route 114) and 0.1 mile north of Raymundo Drive at Canada Road in Woodside. The project includes constructing an interchange at Woodside Road and another at Farm Hill Boulevard to serve the future South County Campus of the College of San Mateo. Estimated cost, $6,140,000, of which $4,380,000 had been budgeted in the 1966–67 fiscal year.

$2,177,300 to complete the financing for extending the Route 92 (19th Avenue) Freeway, 2.3 miles westerly to the site of an interchange with the future Interstate 280 Freeway at Ralston Avenue west of Belmont, with interchanges at West Hillsdale Boulevard, Monterey Street Extended, and Ralston Avenue-Polhemus Road, and for constructing 2.1 miles of this freeway on Brewer Island between east of Marina Lagoon and the San Mateo-Hayward Bridge, with an interchange at Foster City Boulevard. Route 92 traffic will use 19th Avenue between the eastern end of the existing freeway at Grant Street and South Norfolk Street pending future freeway construction. The project includes construction of a temporary connection to South Norfolk Street in San Mateo, including a bridge which will serve a future frontage road across Marina Lagoon. Also included is the addition of ramps on the nearby Bayshore (US 101) Freeway at East Hillsdale Boulevard in San Mateo. Estimated cost, $6,677,300, of which $4,500,000 had been budgeted in the 1966–67 fiscal year.

Widen the Bayshore Freeway (US 101) from six to eight lanes between San Bruno Avenue near San Bruno and Third Street in San Francisco, a distance of 6.7 miles, and revise the directional signing. The project includes widening a bridge across Colma Creek, the Colma and Candlestick Road undercrossings, and three overheads across railroad tracks. Estimated cost, $3,200,000. (Also listed in San Francisco County.)

Resurface and reconstruct the failed sections of the six-lane Bayshore Freeway (US 101) between 0.2 mile south of the Harbor Boulevard Interchange and Brittan Avenue in Redwood City, a distance of two miles. Estimated cost, $275,000.

Rights-of-way on various state highway routes—$3,594,000.

Santa Cloro County

Construct 6.2 miles of the eight-lane Interstate 280 Freeway between 0.1 mile northeast of Woodside Road (Route 114) in Woodside, San Mateo County, and 0.5 mile south of Page Mill Road in Santa Clara County, linking sections completed, under construction or budgeted between Raymundo Drive in Woodside and Los Gatos-Santa Cruz Road (Route 17) in San Jose. The project includes construction of interchanges at Page Mill Road, Alpine Road and Sand Hill Road and bridges across Los Trancos and San Francisquito Creeks. Estimated cost, $9,600,000, of which $5,600,000 will be budgeted in the 1968-69 fiscal year. (Also listed in San Mateo County.)

Grade one mile for the future eight-lane Interstate 280 Freeway in San Jose between Josefa and Race Streets, and construct undercrossings at Lincoln Avenue and Virginia Street, an overcrossing at Bird Avenue, a bridge across Los Gatos Creek, and three railroad separations. Estimated cost, $3,600,000.

Landscape 6.3 miles of the Interstate 280 Freeway between 0.6 mile west of Foothill Boulevard near Los Altos and Page Mill Road in Palo Alto. Estimated cost, $430,000.

Widen El Camino Real (Route 82) from four to six lanes between 0.3 mile east of San Antonio Road in Mountain View and 0.1 mile northwest of Matadero Creek in Palo Alto, a distance of 2.2 miles. The project includes widening the bridges across Adobe and Matadero Creeks. Estimated cost, $1,839,000, of which the state will pay $1,232,000, and Palo Alto, Mountain View, Los Altos and the county the balance.

Install traffic signals and channelization on El Camino Real (Route 82) at Mary Avenue and Bernardo Avenue in Sunnyvale. Estimated cost, $153,000, of which the state will pay $130,000, and the city the balance.

Resurface 0.9 mile of El Camino Real (Route 82) between 0.2 mile north of Curtner Avenue and 0.1 mile south of Alma Avenue in San Jose. Estimated cost, $50,000.

Replace a structurally deficient bridge carrying two lanes of southbound US 101 Expressway traffic across Tar Creek and the Southern Pacific Company's tracks, about 0.6 mile north of the San Benito county line, with a wider structure, and construct approximately one mile of new approaches. Estimated cost, $887,000.

Landscape six miles of the Bayshore Freeway (US 101) between Borregas Avenue in Sunnyvale and Matadero Creek in Palo Alto. Estimated cost, $372,000.

Resurface the two southbound lanes of the Bayshore Freeway (US 101) between 0.6 mile north of the Tully Road Interchange and Santa Clara Street-Alum Rock Avenue (Route 130) in San Jose, a distance of 2.2 miles. Estimated cost, $175,000.

Landscape and tree and functional planting on portions of the Bayshore Freeway (US 101) between south of the Coyote Creek Bridge and San Antonio Street in San Jose, a distance of 5.7 miles. Estimated cost, $116,000.

Construct an equipment undercrossing on Route 237 approximately midway between Maude Avenue in Mountain View and the Bayshore Freeway (US 101) in Sunnyvale. Estimated cost, $100,000, of which the state will pay $70,000, and Sunnyvale the balance.

Rights-of-way on various state highway routes—$8,651,000.

Santa Cruz County

Widen and resurface 0.8 mile of Route 9 between San Lorenzo and Mount Hermon Roads, approximately six miles north of Santa Cruz. Estimated cost, $100,000.

Construct channelization on Route 17 at Upper Glenwood Road, about 10.5 miles north of Santa Cruz. Estimated cost, $70,000.

Grade and pave to reconstruct and widen Bay Street (Federal Aid Secondary Route 1295) from two to six lanes as an urban extension project between Escalova Drive and High Street in Santa Cruz, a distance of 0.7 mile, to serve the University of California at Santa Cruz. Estimated cost, $410,000, to be shared equally by the state and city.

Rights-of-way on various state highway routes—$394,000.

Sonoma County

Widen Route 12 from two to four lanes as an interim improvement pending freeway construction between Brush Creek in Santa Rosa and 0.4 mile east of Calistoga Road, a distance of 2.1 miles, and install traffic signals at Reservoir Drive and Middle Rincon Road. Estimated cost, $766,000, of which the state will pay $750,000, and the city the balance.

Reconstruct one mile of Route 1 on improved alignment bypassing Fort Ross. Estimated cost, $300,000.

NORTHERN COASTAL COUNTIES

Del Norte County

Construct a two-lane expressway on US 101 between the interchange with Route 169 at Klamath and 1.4 miles northerly, and grade an additional two lanes which eventually will carry southbound traffic when this section is converted to a four-lane freeway. Estimated cost, $1,950,000.

Rights-of-way on various state highway routes—$220,000.

Humboldt County

Extend the four-lane US 101 Freeway, under construction between Dean Creek and 0.8 mile south of Garberville, another 2.9 miles southerly to 1.8 miles south of Benbow. The project includes constructing an interchange with the existing highway at Lake Benbow State Park. Estimated cost, $6,300,000.

Resurface US 101 between 5.6 and 12.1 miles south of Scotia. Estimated cost, $120,000.

Realign portions of Route 36 between 2.8 and 4.8 miles east of Bridgeville to ease curves. Estimated cost, $100,000.

Rights-of-way on various state highway routes—$280,000.

Lake County

Rights-of-way on various state highway routes—$385,000.

Mendocino County

Construct the four-lane US 101 Freeway between Squaw Creek, 0.9 mile north of Cummings Post Office, and 0.9 mile north of Cedar Creek, 4.4 miles northerly, with an interchange at Scandia. The project includes constructing a 265-foot-high and 800-foot-long highway embankment at Grizzly Creek. Estimated cost, $15,000,000, of which $9,500,000 will be budgeted in the 1968-69 fiscal year.

$1,433,100 to complete the financing of construction in progress extending the above budgeted project 2.1 miles southerly to 1.2 miles south of Cummings Post Office. The project includes construction of an interchange at Cummings and the highest highway embankment in California, and probably the world, at Squaw Creek. It will be 384 feet high and 900 feet long. Estimated cost, $6,433,100, of which $5,000,000 had been budgeted in the 1966-67 fiscal year.

Rights-of-way on various state highway routes—$425,000.

SAN JOAQUIN AND CENTRAL MOUNTAIN COUNTIES

Alpine County

Construct a two-lane expressway on Route 4 between 1.2 and 3.2 miles northeast of the Calaveras county line. Estimated cost, $1,110,000.

Rights-of-way on various state highway routes—$20,000.

Amador County

Widen Route 49 to a 64-foot city street section between Main Street in Jackson and the west city limit, and construct truck passing lanes between this point and Martell, a total distance of 1.7 miles. Estimated cost, $420,000, of which the state will pay $414,000, and the city the balance.

Rights-of-way on various state highway routes—$250,000.

Calaveros County

Rights-of-way on various state highway routes—$25,000.

Fresno County

$2,339,000 to complete the financing for grading and building the structures for the initial four lanes of the eventual eight-lane Interstate 5 (Westside) Freeway, between 0.2 mile south of Fresno-Coalinga Road, about 15 miles northeast of Coalinga, and 0.3 mile south of Manning Avenue, about 22.5 miles west of San Joaquin, a distance of 27.7 miles. The project includes con-

structing interchanges at Fresno-Coalinga Road, Route 33 and Kamm Avenue. Estimated cost, $5,484,000, of which $3,145,000 had been budgeted in the 1966–67 fiscal year.

Construct the initial four lanes of the ultimate eight-lane Interstate 5 (Westside) Freeway between Route 41 in Kings County two miles south of Kettleman City, and 0.2 mile north of the Fresno-Kings county line, and grade another 0.4 mile southeast of Route 41, a total distance of 10.7 miles. The project includes constructing half-interchanges at Route 41 and Lassen Avenue at the project's northern terminus. Estimated cost, $6,064,000, of which $2,764,000 will be budgeted in the 1968–69 fiscal year. (Also listed in Kings County.)

Widen Route 69 to 20 feet between 0.4 mile south and 0.1 mile north of Mill Creek Bridge just north of the Tulare county line. Estimated cost, $100,000.

Widen the Belmont Avenue Overcrossing on the Route 99 Freeway in Fresno from two to four lanes. Estimated cost, $350,000, of which the state will pay $80,000, and the county the balance.

Rights-of-way on various state highway routes—$1,155,000.

Inyo County

Widen 1.9 miles of Route 168 from two to four lanes between 0.1 mile west of Meadow Lane and the west city limit of Bishop. Estimated cost, $250,000.

Kern County

Extend the four-lane Route 58 Freeway from 1.1 miles west of the Tehachapi Overhead 12.7 miles easterly through that city to a completed section east of Cameron. The project includes constructing the Old Town, Mill Street, Summit, Sand Canyon Road and Cameron Canyon Road Interchanges, two crossings of the A.T. & S.F. and Southern Pacific Company's tracks, and a bridge across Cache Creek. Estimated cost, $7,700,000, of which $4,700,000 will be budgeted in the 1968–69 fiscal year.

Construct the initial four lanes of the ultimate eight-lane Interstate 5 (Westside) Freeway between Route 119 and 0.4 mile south of Lerdo Highway, about 14 miles west of Shafter, a total distance of 23.5 miles. The project includes constructing interchanges at Route 119, Route 43, Stockdale Road, Route 58, and Seventh Standard Road-Rowlee Road, and grading, planting trees and installing an irrigation system for a future safety roadside rest just north of Tracy Avenue. Estimated cost, $10,843,000, of which $3,843,000 will be budgeted in the 1968–69 fiscal year.

Tree and functional planting on 5.1 miles of the Interstate 5 Freeway between the Los Angeles county line and Fort Tejon. Estimated cost, $32,000.

Convert the four-lane Route 99 Expressway to six-lane freeway between 1.4 miles south of Route 46 in Famoso and 0.2 mile north of Sherwood Avenue in McFarland, a distance of 6.5 miles, completing the conversion of this route to full freeway standards between its inception at Wheeler Ridge in Kern County and Madera, a distance of 140 miles. It includes constructing an interchange at Whistler Road. Estimated cost, $3,075,000.

Tree and functional planting on the Route 99 Freeway between Wheeler Ridge and 11 miles northerly, including at the interchange with Interstate 5. Estimated cost, $90,000.

Construct a bridge to carry Route 119 traffic across the future California Aqueduct at the Western Waterworks. The project includes widening the bridge across the nearby Kern River and constructing a detour to serve during the bridge construction period. Estimated cost, $361,000, of which state highway funds will finance $88,000, and the Department of Water Resources the balance.

Grade and pave to reconstruct and widen South H Street (Federal Aid Secondary Route 882) in Bakersfield from two to four lanes as an urban extension project between Ming Avenue and White Lane, a distance of 1.5 miles. Estimated cost, $520,000, to be shared equally by the state and city.

Rights-of-way on various state highway routes—$2,440,000.

Kings County

Construct the initial four lanes of the ultimate eight-lane Interstate 5 (Westside) Freeway between Route 41 in Kings County, two miles south of Kettleman City, and 0.2 mile north of the Fresno-Kings county line, and grade another 0.4 mile southeast of Route 41, a total distance of 10.7 miles. The project includes constructing half-interchanges at Route 41 and Lassen Avenue at the project's northern terminus. Estimated cost, $6,064,000, of which $2,764,000 will be budgeted in the 1968–69 fiscal year. (Also listed in Fresno County.)

Rights-of-way on various state highway routes—$450,000.

Madera County

Extend a four-lane expressway section under construction on Route 152 another 9.5 miles easterly between 0.9 mile west of County Road 10 and Route 99 at Califa. The project includes constructing bridges across Ash and Berenda sloughs, and an interchange with Robertson Boulevard (Route 233). Estimated cost, $2,464,000.

Replace a two-lane timber bridge across the Fresno River on North Lake Street (Federal Aid Secondary Route 866) in Madera as an urban extension project with a four-lane concrete structure. Estimated cost, $232,000, to be shared equally by the state and city.

Rights-of-way on various state highway routes—$30,000.

Mariposa County

Rights-of-way on various state highway routes—$150,000.

Merced County

Construct a four-lane expressway on Route 152 between 0.1 mile east of Ward Road in Los Banos and 11 miles easterly. The project includes constructing an interchange with Elgin Road (Route 33) north of Dos Palos. Estimated cost, $3,900,000, of which $1,100,000 will be budgeted in the 1968–69 fiscal year.

Tree and functional planting on the Interstate 5 (Westside) Freeway between 0.1 mile south of Route 152 west of Los Banos and 7.2 miles northwesterly. Estimated cost, $56,000.

Rights-of-way on various state highway routes—$1,633,000.

Mono County

Convert US 395 from two-lane expressway to four-lane freeway between six miles south and 1.2 miles north of Casa Diablo. The project includes constructing an interchange with Route 203 and realigning 1.5 miles of Route 203 west of the interchange. Estimated cost, $2,200,000.

Construct a two-lane expressway on US 395 on improved alignment between 9.1 and 10.1 miles north of Bridgeport. Estimated cost, $120,000.

Rights-of-way on various state highway routes—$414,000.

San Joaquin County

Complete the substructure and construct the superstructure of the paired Interstate 5 Freeway bridges across the Stockton Channel in Stockton, and a portion of the interchange between Interstate 5 and the future Crosstown (Route 4) Freeway. Estimated cost, $21,755,000, of which $16,255,000 will be budgeted in the 1968–69 fiscal year.

$5,305,000 to complete the financing for constructing Interstate 5 as an eight-lane freeway between Stockton Channel in Stockton and Country Club Boulevard, 1.7 miles northerly, and as a six-lane freeway between this point and March Lane, 1.5 miles farther north. This project involves constructing interchanges at Pershing Avenue, Mount Diablo Boulevard, Country Club Boulevard-Telegraph Avenue, and March Lane. Estimated cost, $9,650,000, of which $4,345,000 had been budgeted in the 1966–67 fiscal year. (The construction of paired bridges and approaches across Smith's Canal and the Calaveras River was financed in the 1965–66 fiscal year budget.)

Extend the previously budgeted six-lane Interstate 5 Freeway 2.7 miles northerly from March Lane, just north of the Calaveras River, to Hammer Lane in Stockton. The project includes constructing an interchange at Benjamin Holt Drive and one-half of the interchange at Hammer Lane. Estimated cost, $4,640,000, of which $1,640,000 will be budgeted in the 1968–69 fiscal year.

Construct an overcrossing and on- and off-ramps for northbound traffic on Route 99 at Milgeo Avenue at the north city limit of Ripon. Estimated cost, $480,000.

Widen Route 120 from two to four lanes and construct left-turn lanes at Airport Way, and install traffic signals at this intersection, approximately one mile west of Manteca. Estimated cost, $185,000, of which the state will pay $170,000, and the county the balance.

Tree and functional planting on the Interstate 580 Freeway between 1.6 miles east of the Jefferson Road Overcrossing, southeast of the Tracy Airport, and 7.4 miles northwesterly. Estimated cost, $56,000.

Rights-of-way on various state highway routes—$2,730,000.

Solano County

Construct passing lanes at three locations, widen one bridge and lengthen 56 culverts on Route 12 between 0.5 mile west of Rio Vista and 11.3 miles westerly. The project includes installing highway lighting at the intersection of Route 12 and Birds Landing Road (Route 113). Estimated cost, $326,000.

Install lighting on the Interstate 80 Freeway bridges across Carquinez Strait and

guard railing on the west bridge. Estimated cost, $258,000. (Also listed in Contra Costa County.)

Tree and functional planning on eight miles of the Interstate 80 Freeway between Ledgewood Creek, near the west city limit of Fairfield, and Alamo Creek, at the south city limit of Vacaville. Estimated cost, $200,000.

Replace the ferry carrying Route 220 traffic across Steamboat Slough separating Solano and Sacramento Counties at Howard Landing, about four miles west of Walnut Grove in Sacramento County. Estimated cost, $100,000. (Also listed in Sacramento County.)

Rights-of-way on various state highway routes—$175,000.

Stanislaus County

Resurface 2.9 miles of the Route 99 Expressway between Pelandale Avenue and the Stanislaus River, and install traffic signals and channelization at the intersection with Broadway (Route 219). Estimated cost, $140,000, of which the state will pay $128,000, and the county the balance.

Widen Route 108 from two to four lanes between Bowen Avenue in Modesto and 0.4 mile northerly, construct channelization, and install traffic signals at the intersection with Floyd Avenue. Estimated cost, $116,000, of which the state will pay $112,000, and the city the balance.

Construct 0.5 mile of Route 108 on improved alignment to eliminate four sharp curves, approximately 1.8 miles northeast of Riverbank. Estimated cost, $89,000.

Rights-of-way on various state highway routes—$835,000.

Tulare County

Construct a two-lane expressway on Route 65 between 0.5 mile north of Avenue 32 south of Ducor and Avenue 120 north of Terra Bella, a distance of 10.7 miles. The project includes constructing bridges across White River and Deer Creek, and an underpass for the Southern Pacific Company's tracks just north of White River. Estimated cost, $2,420,000.

Rights-of-way on various state highway routes—$935,000.

Tuolumne County

Rights-of-way on various state highway routes—$150,000.

SACRAMENTO VALLEY AND NORTHERN COUNTIES

Butte County

Landscape the Route 99 Freeway between Palmetto and Lassen Avenues in Chico, and tree and functional planting between Lassen Avenue and 0.3 mile north of the bridge across Mud Creek. Estimated cost, $360,000.

Replace a narrow bridge across Lindo Channel on Route 32, about two miles west of Chico, with a wider structure and construct approaches. Estimated cost, $200,000.

Rights-of-way on various state highway routes—$4,000.

Colusa County

$2,325,000 to complete the financing for extending the four-lane Interstate 5 Freeway section in Arbuckle 5.5 miles southerly and approximately eight miles northerly to Husted Road south of Williams. The project includes revising the Hillgate Road Interchange and constructing an interchange north of Arbuckle. Estimated cost, $6,725,000, of which $4,400,000 had been budgeted in the 1966–67 fiscal year.

Construct the four-lane Interstate 5 Freeway between two miles south of the future Interstate 505 Freeway south of Dunnigan, Yolo County, and the above construction in progress south of Arbuckle, Colusa County, a distance of ten miles. The project includes construction of interchanges with the Interstate 505 Freeway, Yolo County Roads 8 and P6 and County Line Road, and bridges across Oat and Buckeye Creeks. Estimated cost, $6,600,000, of which $2,300,000 will be budgeted in the 1968–69 fiscal year. (Also listed in Yolo County.)

Replace the decking on the two-lane bridge across the Sacramento River on Route 20 linking Sutter County with Colusa County at Meridian. Estimated cost, $300,000. (Also listed in Sutter County.)

Reconstruct portions of Route 45 to ease curves at five locations between Colusa and 4.6 miles northerly. The project includes installing automatic signals and truck stopping lanes at the crossing of the Southern Pacific Company's tracks southeast of Brown Road. Estimated cost, $140,000.

Rights-of-way on various state highway routes—$916,000.

El Dorado County

$6,030,000 to complete the financing for extending a four-lane US 50 Freeway section 7.5 miles westerly from Missouri Flat Road to a connection with an existing two-lane expressway section, 0.8 mile west of Shingle Springs. The project includes constructing interchanges at Missouri Flat, Greenstone and Ponderosa Roads. Estimated cost, $9,030,000, of which $3,000,000 had been budgeted in the 1966–67 fiscal year.

Replace a narrow and structurally inadequate bridge across Weber Creek on Route 49, approximately two miles south of Placerville, with a wider, reinforced concrete structure. Estimated cost, $75,000.

Replace a bridge on Route 193 across Blackberry Draw, approximately nine miles east of Cool, with a structure on improved alignment and construct new aproaches. Estimated cost, $65,000.

Rights-of-way on various state highway routes—$260,000.

Glenn County

Tree planting on portions and shrub planting in the median of the Interstate 5 Freeway to eliminate headlight glare on the 22-mile section between 2 miles south of Willows and the Tehama county line. Estimated cost, $165,000.

Lassen County

Reconstruct the base and surfacing of US 395 between Ravendale and 7.3 miles southerly. The project includes widening several highway cuts to facilitate snow removal. Estimated cost, $370,000.

Rights-of-way on various state highway routes—$271,000.

Modoc County

Place base and surfacing to complete the construction of a Route 139 expressway section between Route 299 near Canby and 5.7 miles northerly, and install left-turn lanes at the intersection of the two highways. Grading is under way under previous financing. Estimated cost, $730,000.

Rights-of-way on various state highway routes—$13,000.

Nevada County

Landscape the Route 20 Freeway through Nevada City, and tree and functional planting on an additional two miles of adjacent sections. Estimated cost, $250,000.

Construct portions of Route 49 on improved alignment between North San Juan and 1.3 miles westerly. Estimated cost, $100,000.

Rights-of-way on various state highway routes—$70,000.

Placer County

Construct an interchange on the Interstate 80 Freeway, approximately one mile north of Auburn, to serve Luther Road and Auburn Ravine Road. Estimated cost, $954,000.

Install traffic signals and left-turn lanes on Route 49 at Dry Creek Road, approximately three miles north of Auburn. Estimated cost, $90,000, of which the state will pay $80,000, and the county the balance.

Improve drainage on Route 89 at Madden Creek, approximately three miles north of the El Dorado county line. Estimated cost, $60,000.

Rights-of-way on various state highway routes—$234,000.

Plumas County

Place base and surfacing to complete the construction of the two-lane Route 36 Expressway between Chester and seven miles easterly. The project includes completion of a safety roadside rest overlooking Lake Almanor. Grading is underway under previous financing. Estimated cost, $580,000.

Rights-of-way on various state highway routes—$372,000.

Sacramento County

Extend the previously budgeted eight-lane Interstate 5 Freeway (between J Street in Sacramento and the future Interstate 880 Freeway near San Juan Road) 1.4 miles southerly to 0.6 mile south of Broadway. The project includes construction of an underpass at the Western Pacific and Southern Pacific Company's tracks at R Street and an interchange at P-Q Streets. Construction in the interchange area with the Interstate 80 Freeway will be financed subsequently. Estimated cost, $11,750,000, of which $6,750,000 will be budgeted in the 1968–69 fiscal year.

Construct the four-lane Interstate 5 Freeway bridge across the Sacramento River, linking the recently completed two-lane Interstate 5 Expressway section between Route 99 and Elkhorn, Sacramento County, which

will serve the future Natomas Airport, with Yolo County, and construct the bridge approaches. Estimated cost, $10,300,000, of which $5,300,000 will be budgeted in the 1968–69 fiscal year. (Also listed in Yolo County.)

$7,799,000 to complete the financing for constructing the eight-lane Interstate 5 Freeway between J Street in Sacramento and the future Interstate 880 Freeway near San Juan Road, and the six-lane Interstate 5 Freeway from this point to Route 99 at Bayou Way, a distance of approximately seven miles, connecting to the recently completed two-lane expressway section westerly to Elkhorn. The project includes constructing a northbound on-ramp from L Street in Sacramento, an interchange at J-I Streets, and connections to the I Street Bridge and the Old Sacramento Historic Project area, an interchange at Richards Boulevard, paired freeway bridges across the American River, plus interchanges at Garden Highway, West El Camino Avenue extended, the Interstate 880 Freeway, Del Paso Road and Route 99. Estimated cost, $22,099,000, of which $11,300,000 had been budgeted in the 1966–67 fiscal year, and another $3,000,000 in the 1965–66 fiscal year for the bridges across the American River and the Richards Boulevard Interchange.

Construct the six-lane Interstate 880 Freeway between the Interstate 5 Interchange and Winters Street in the Del Paso Heights area of Sacramento, a distance of about 5.9 miles. The project includes constructing interchanges at Northgate Boulevard, Norwood Avenue, Marysville Boulevard-16th Street, and an overhead across the Sacramento Northern railroad tracks just east of Rio Linda Boulevard. Estimated cost, $11,900,000, of which $6,000,000 will be budgeted in the 1968–69 fiscal year.

Grade and build the structures for the interchange between the six-lane Interstate 80 and Interstate 880 Freeways in Sacramento. Estimated cost, $8,920,000, of which $4,420,000 will be budgeted in the 1968–69 fiscal year.

Construct the embankment approaches for the future Interstate 880 Freeway bridges across the Sacramento River at Bryte Bend and at the Southern Pacific Company's tracks east of the Yolo Causeway. Estimated cost, $2,492,000. (Also listed in Yolo County.)

Widen the existing four-lane Route 80 Freeway to six lanes by adding lanes in the median between 0.3 mile west of Marconi Avenue in Sacramento and 0.3 mile east of Watt Avenue, a distance of three miles. Estimated cost, $850,000.

Landscape portions of the Interstate 80 Freeway in Sacramento between the west side of Fifth Street and Alhambra Boulevard, a distance of 1.9 miles. Estimated cost, $290,000.

Replace the ferry carrying Route 220 traffic across Steamboat Slough separating Solano and Sacramento Counties at Howard Landing, about four miles west of Walnut Grove in Sacramento County. Estimated cost, $100,000. (Also listed in Solano County.)

Construct an interchange on J Street (Federal Aid Secondary Route 930) at Carlson Drive near Sacramento State College in Sacramento as an urban extension project. Estimated cost, $1,000,000, to be shared equally by the state and city.

Rights-of-way on various state highway routes—$13,775,000.

Shasta County

$8,917,000 to complete the financing for extending the Interstate 5 Freeway 3.5 miles northerly from two miles north of Redding as a six-lane facility, and for another 12.6 miles northerly to three miles north of O'Brien as a four-lane freeway, connecting to freeway construction in progress to the Sacramento River Bridge at Antler. North of the Pit River Bridge, work consists of constructing two lanes to carry northbound traffic and reconstructing and widening the existing two-lane highway for southbound traffic. The project includes constructing interchanges at Oasis Road, Pine Grove, Shasta Dam Boulevard (Route 151), Mountain Gate, Fawndale Road, Bridge Bay, Turntable Bay and O'Brien, and safety roadside rests one mile north of the Pit River Bridge and 1.5 miles south of O'Brien overlooking Shasta Lake. It also includes constructing truck climbing lanes on steep uphill grades. Widening of the Pit River Bridge was recently completed under previous financing. Estimated cost, $16,417,000, of which $7,500,000 had been budgeted in the 1966–67 fiscal year.

Construct the four-lane Route 44 Expressway between Hilltop Road, just east of the Interstate 5 Freeway in Redding, and four miles easterly. The project includes constructing an interchange at Hilltop Road, paired freeway bridges across Churn Creek, and reconstructing Airport Road on new alignment to intersect the expressway just west of Oregon Trail Road. Estimated cost, $2,300,000.

Reconstruct and widen Shasta Dam Boulevard (Route 151) from two to four lanes between just east of the Southern Pacific Company's underpass in Project City and Cascade Boulevard, just west of the Interstate 5 Freeway, a distance of 1.2 miles. The project includes constructing a one-way couplet for opposing lanes of traffic between Hardenbrook Avenue and just west of Montana Avenue. Estimated cost, $445,000.

Rights-of-way on various state highway routes—$481,000.

Sierra County

Widen portions of Route 49 between Yuba Pass and 1.6 miles west of Route 89 near Sattley, and improve drainage. Estimated cost, $100,000.

Siskiyou County

Construct 19.7 miles of the four-lane Interstate 5 Freeway between the Shasta River Bridge north of Weed and 3.8 miles south of Yreka. The project includes constructing an interchange with Edgewood Road just north of the bridge; an interchange and two safety roadside rests near the Siskiyou County Airport; and interchanges with Louie Road east of Gazelle and the Routes 99-97 cutoff (Federal Aid Secondary Route 1166) near Granada. It also includes minor improvements to approximately two miles of the existing freeway south of the river. Work will start soon to construct paired freeway bridges over the Southern Pacific Company's tracks near the county airport and near Granada under previous financing. Estimated cost, $9,750,000, of which $6,750,000 will be budgeted in the 1968–69 fiscal year.

$2,101,400 to complete the financing for constructing the four-lane Interstate 5 Freeway between 11.1 miles north of Yreka and Bradley-Henley Road near Hornbrook, a distance of 3.3 miles. The project includes constructing a bridge across the Klamath River to connect the existing highway north of the river with a future safety roadside rest which will be constructed on the river's south bank and portions of the paired freeway bridges across the river. Estimated cost, $5,601,400, of which $3,500,000 had been budgeted in the 1966–67 fiscal year.

Replace a bridge across Ti Creek on Route 96, approximately 14 miles north of Somesbar, with a wider structure on improved alignment. Estimated cost, $88,000.

Tree and functional planting on the Interstate 5 Freeway between 4.6 miles south and 1.5 miles north of Mount Shasta. Estimated cost, $60,000.

Rights-of-way on various state highway routes—$1,238,000.

Sutter County

Resurface Route 99 between its junction with Route 70 and 1.4 miles north of the Feather River, a distance of 5.9 miles. Estimated cost, $150,000.

Replace the decking on the two-lane bridge across the Sacramento River on Route 20 linking Sutter County with Colusa County at Meridian. Estimated cost, $300,000. (Also listed in Colusa County.)

Rights-of-way on various state highway routes—$100,000.

Tehama County

Reconstruct Route 36 on new alignment generally north of the existing highway, between seven and 12 miles west of Red Bluff, to eliminate 13 fords on Dibble Creek. Estimated cost, $655,000.

Tree and functional planting on the 28.7-mile stretch of the Interstate 5 Freeway between the Glenn county line and the North Red Bluff Interchange. The project includes landscaping the interchange at Red Bluff. Estimated cost, $365,000.

Rights-of-way on various state highway routes—$67,000.

Trinity County

Rights-of-way on various state highway routes—$57,000.

Yolo County

Construct the four-lane Interstate 5 Freeway bridge across the Sacramento River, linking the recently completed two-lane Interstate 5 Expressway section between Route 99 and Elkhorn, Sacramento County, which will serve the future Natomas Airport, with Yolo County, and construct the bridge approaches. Estimated cost, $10,300,000, of which $5,300,000 will be budgeted in the 1968–69 fiscal year. (Also listed in Sacramento County.)

Construct the embankment approaches for the future Interstate 880 Freeway bridges

across the Sacramento River at Bryte Bend and at the Southern Pacific Company's tracks east of the Yolo Causeway. Estimated cost, $2,492,000. (Also listed in Sacramento County.)

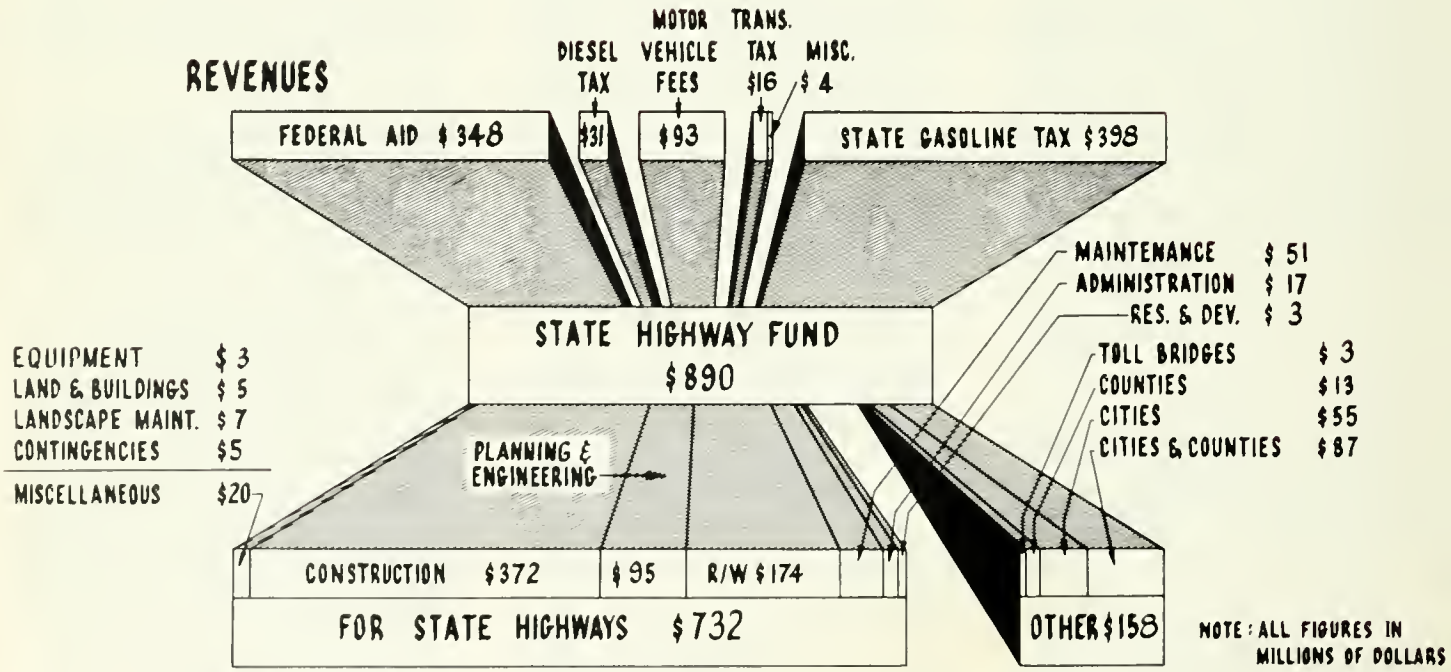
Construct the four-lane Interstate 5 Freeway between two miles south of the future Interstate 505 Freeway south of Dunnigan, Yolo County, and construction in progress south of Arbuckle, Colusa County, a distance of ten miles. The project includes construction of interchanges with the Interstate 505 Freeway, Yolo County; Roads 8 and P6 and County Line Road, and bridges across Oat and Buckeye Creeks. Estimated cost, $6,600,000, of which $2,300,000 will be budgeted in the 1968–69 fiscal year. (Also listed in Colusa County.)

Rights-of-way on various state highway routes—$1,221,000.

Yuba County

Reconstruct and widen Route 20 on improved alignment between near the north city limit of Marysville and 2.7 miles northeasterly to improve sight distances for motorists and eliminate flooding of the highway. Estimated cost, $980,000.

$310,000 to complete the financing for constructing the initial two lanes of an eventual four-lane freeway on Route 70 between Bear River and just south of McGowan Road, south of Marysville, and for constructing a four-lane freeway from this point to Route 65, a total distance of 8.4 miles, with interchanges at McGowan Road and Route 65. The project includes constructing almost one mile of Route 65 south of the completed freeway to Marysville as a four-lane divided highway. Estimated cost, $2,810,000, of which $2,500,000 had been budgeted in the 1966–67 fiscal year.



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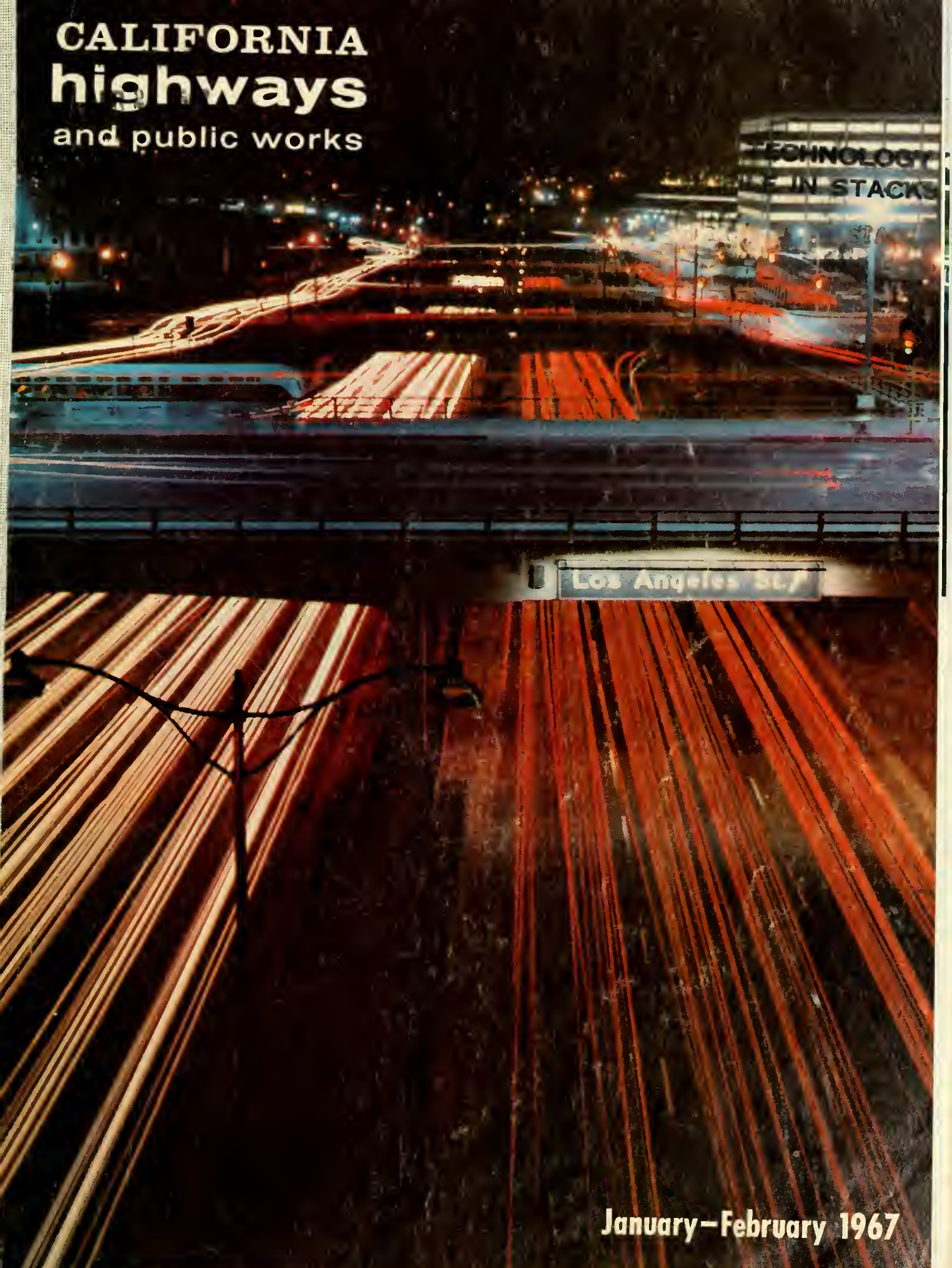

January–February 1967

The complaints about the problem of getting through Sacramento are rapidly becoming a thing of the past, as the city's freeway system comes on apace. Construction on Interstate 80 is seen in lower portion of high altitude photo above, and its junction with US 50 at lower right. Here Interstate 80 turns north, and US 50 turns east. Interstate 5 will come down left-hand side of photo, along edge of downtown section. River across center is the American; larger one looping into lower left of photo is the Sacramento. Nine highway and railroad bridges can be seen, including the new Interstate 80 Pioneer Memorial Bridge at lower left. Two additional highway bridges are under construction, including Interstate 5 crossing seen at left center.

CALIFORNIA
highways
and public works

VOLUME 46 JANUARY–FEBRUARY 1967 NOS. 1–2

TABLE OF CONTENTS 3

FREEWAY BEAUTY 4
By Valley Knudsen

SOUTHLAND FREEWAY PROGRESS 8

BRIDGE STEEL WELDS 11
By Art German

CHANGES IN HIGHWAY COMMISSION 12

STORM HAVOC IN DISTRICT 6 14
By Ed Tiedemonn

CALIFORNIA HIGHWAY NEEDS 17
By J. C. Womack

HIGHWAY TO SPACE BASE 33
By Richard R. Crandall

BARTLETT AWARD FOR J. C. WOMACK 36

GOVERNOR'S DESIGN AWARD 37

MINIMUM SPEED LIMITS 38
By Norman Wingerd

TRAVEL TIME STUDY 41
By Peter G. Koltnow

RIO VISTA BRIDGE 44

BYLINES 46

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The yearly index is no longer printed as part of the magazine but on separate pages punched so that they can be inserted into a three-ring binder. Readers who want copies of the index covering the issues for 1966 should send their requests to the editor.

Freeway Beauty

BY MRS. VALLEY KNUDSEN, PRESIDENT
LOS ANGELES BEAUTIFUL

Our landscaped freeways of today are forerunners of green belts through our cities of tomorrow—and they may be virtually the only ones we have. Thanks to our progressive California Highway Commission much of our freeway system is newly planted, and in a few years we will enjoy some of the most beautiful roadways in the country.

"Beauty is good business," as Los Angeles Beautiful has consistently maintained for the past 17 years. This is particularly applicable to our park-like freeways. To the multimillion-dollar tourist trade, it is important whether our visitors drive down concrete canyons, or whether they travel avenues of flowering ground cover and blossoming trees and shrubs.

To us who live and work here, the freeways are more than just an efficient way to get from one place to another. They are not only the fastest, safest route of travel but they are also the most enjoyable because of the beautifully landscaped surroundings.

We would be more readily reminded of this fact if we had retained the original designation of these modern highways, namely, "parkways." This is by far a more apt description of what we hope is achieved in maintaining our highway system.

Our sensitivity to beauty can be dulled unless we jealously guard our policy of landscaping freeways. We believe the motoring public prefers to travel highways that are surrounded by ivy, shrubs, flowers, trees and a variety of plants, rather than to be visually trapped by barren concrete embankments, garish billboards and unsightly junkyards.

Los Angeles Beautiful believes that in addition to all of its other advantages the freeway should provide in all of our daily motoring an interlude of natural beauty.

"Automobility," a word coined to describe our utter dependence upon wheels, will be with us for many years to come. The growing public demand for ever increasing flexibility of movement would seem to create imponderable problems of engineering. And yet, the freeways continue to stretch across the landscape in ribbons of concrete and asphalt. To the extent that they are designed and maintained as areas of beauty for enjoyment as well as utility, our purpose is well served.

BELOW: This recently completed landscaping near the approach to the Vincent Thomas Bridge in San Pedro features broad expanses of yellow hymenocyclus and white pelargonium against a backdrop of myoporum, phormium and pines.

A view of the Harbor Freeway in downtown Los Angeles, which was planted in the mid-1950's. Ivy used as ground cover sets off the Mexican fan palms.

ABOVE: A section of the Harbor Freeway-Santa Monica Freeway Interchange in downtown Los Angeles, planted in 1962. An unusually high cut created a condition of dense shade on the south side. Ivy was used as ground cover. Shrubs and trees included eucalyptus, tipuana, oleander and callistemon.

BELOW: The four-level structure in Los Angeles, landscaped in the early 1950's, is probably the first multi-level freeway interchange to receive such treatment. The mixed shrubs included leptospermum, pittosporum and sycamores, with ailanthus added later.

ABOVE: Landscaping on the Glendale-Golden State Freeway Interchange features a ground cover of mesembryanthemum edule and eucalyptus trees. Mixed shrubs included acacia melaleuca, pittosporum and callistemon.

BELOW: A landscaped section along the Hollywood Freeway near Glendale Boulevard. It stresses a simple but effective use of lawn and liquidambar trees.

Southland Freeway Progress

Traffic separation at airport eliminates congestion.

WORLD'S GREATEST RAPID TRANSIT SYSTEM

By Marcia J. Mickelsen

During the latter half of 1966, 31.5 miles were added to the District 7 freeway network. In the three counties of Los Angeles, Orange, and Ventura this makes a total of 526 freeway and expressway miles at year's end, or roughly one-third of the mileage called for by the master plan adopted in 1959.

The most important accomplishment was the simultaneous opening of 10.6 miles of the San Gabriel River Freeway (Interstate 605) on July 1. This work involved four individual contracts and the expenditure of $24,610,000, and brought to completion the San Gabriel River Freeway between the Santa Ana Freeway in Norwalk and the San Diego Freeway (Interstate 405) in and near Los Alamitos and Long Beach.

With the opening of this lengthy section, it is possible for the motorist to travel for 22 miles on an eastern bypass of the Los Angeles metropolitan area from the San Bernardino Freeway (Interstate 10) on the north to the San Diego Freeway on the south.

A host of communities—from Rossmoor to Santa Fe Springs—received direct benefit from the new freeway as people of these communities are now able to make unhindered connections with three major Interstate Routes—405, 5 and 10. Also, travel from the Long Beach area to the northeast part of Los Angeles County (and beyond) is no longer dependent upon the Long Beach Freeway.

Eventually, noninterstate extensions of the San Gabriel River Freeway will provide continuous travel for 30 miles from the Foothill Freeway (Interstate 210) on the north via Route 243 to the Pacific Ocean on the south via Route 240.

Aside from freeway construction, but tantamount to the total transportation picture in the Los Angeles area,

31.5 MORE MILES ADDED SINCE JUNE

especially in terms of air-ground destination travel, was the summertime completion of a traffic separation project at Century and Sepulveda Boulevards near the passenger entrance to International Airport. A joint project of the City of Los Angeles and the state, this improvement cost about $1 million.

On the Ridge Route the task of converting this important highway to interstate standards continued, with the completion in September of the second of 12 projects planned to provide 45 miles of eight-lane freeway through the mountains between the Los Angeles city limits and the Kern County line. Cost of the 12 Los Angeles County projects will total $86 millions. The September opening added nearly four miles of freeway, including three bridges, to Interstate 5 along the top of the ridge from near Gorman to Cuddy Creek in Kern County, at a cost of $5.9 millions.

An extension of the Hollywood Freeway, a two-mile section from Magnolia Boulevard to Victory Boulevard in North Hollywood, was completed in September. Known numerically as Route 170, the Hollywood Freeway extension provides access to and from the San Fernando Valley, midway between Interstate Routes 405 and 5. The $5.9 million contract for this job was carried out in time for the section to be dedicated as a major feature of National Highway Week

Early in October, a six-mile extension of the Antelope Valley Freeway (Route 14) between the Angeles Forest Highway at Vincent and Avenue P-8 in Palmdale was opened to traffic. This construction, performed at a cost of $5.4 million, completes 28 continuous miles of four- and six-lane

"District 7 Freeway Progress" map as of November 1966 shows status of system at approximate time of writing of article. Note various alternate routes now available, which have siphoned off considerable traffic load from older freeways.

Below left: Section of new Hollywood Freeway extension, with new businesses which have sprung up beside it. Below right: San Gabriel River Freeway (Interstate 605) at the Willow Street-Katella Avenue Interchange in Long Beach.

Seattle Public Library
APR 21 1967

Miss Orange County aided District Engineer E. T. Telford in dedicating Riverside Freeway.

Above: A formal parade of cars opened a 10.6-mile stretch of the San Gabriel River Freeway following dedication July 1st.

Below: The Santa Monica Freeway (Interstate 10), now open all the way to its junction with Route 1 at the coast, is carrying its share of traffic load.

freeway for the motorist in the Antelope Valley region, from a point near Solemint to the north city limit of Palmdale. Included in this work was a Route 14/Route 138 separation structure and a bridge to span the California Aqueduct. Since then, work has been started on a nine-mile segment from Lancaster north to the Kern county line, a $7.8 million job.

In Orange County, six miles of the San Diego Freeway (Interstate 405) were dedicated on November 18. Cost of construction between Beach Boulevard and Harbor Boulevard in Costa Mesa was $10.7 million. With the opening of this section on December 8, the traveler can follow Interstate 405 continuously for more than 61 miles in two counties, bypassing the Los Angeles metropolitan area on the western side.

On the Newport Freeway (Route 55), construction was finished in mid-December on a portion between Warner Avenue in the Santa Ana-Tustin area, and Bristol Street-Palisades Road in Costa Mesa. This 3.9-mile, $5.3 million project included parts of the interchange with the future San Diego Freeway (Interstate 405). Now, the motorist may drive uninterruptedly for more than 13 miles on the Newport Freeway—between the Riverside Freeway (Route 91) and Bristol Street-Palisades Road.

A project to convert the Riverside Freeway from expressway to six-lane freeway for 5.8 miles between Lemon Street in Fullerton and the Newport Freeway in Anaheim was also completed in December. Cost of this project was $5.6 million.

An inspector applies film to a welded area before making a radiographic check for hidden flaws.

BRIDGE STEEL WELDS

FASTER THAN THE EYE

By Art German

Both radiography with gamma rays, and ultrasonic waves, are being used to test the many miles of steel welds inside the girders on the new San Mateo-Hayward Bridge now under construction. Only 17 inches of weld can be tested with each exposure.

E. R. Foley, Chief Engineer of Bay Toll Crossings, explained the unusual techniques in this way:

"A bridge is a major investment which must serve the public for a long time. The testing program is an important device to assure that the structure meets the required standards."

In radiography with gamma rays, radioactive isotopes are used, which require a much shorter exposure time than the cathode rays used in the more common X-rays used in the medical profession. Any imperfections in the welds are shown immediately. These may be porosity (bubbles of gas) inside the weld, slag (entrapped residue), lack of fusion with the metal, cracks, and lack of complete penetration.

Although the radiographic tests are being made at all six fabrication yards working on the bridge—Richmond, Oakland, Lockeford, Napa, Maywood, and Fontana—the major testing is at Richmond. Here the work proceeds virtually around the clock, and more than 10,000 "pictures" will be made at this one yard alone before the structure is completed.

The ultrasonic process is cheaper and faster, but the radiography yields a permanent record on film, much like a medical X-ray. Both processes are superior to visual inspection.

Gordon C. Luce

Fred C. Jennings

Changes In

NEW AGENCY ADMINISTRATOR,

Gordon C. Luce, 41, of La Jolla, has been named the new Administrator of the State Transportation Agency by Governor Ronald Reagan.

Prior to his appointment Luce was senior vice president of a savings and loan association in San Diego with which he had been associated for 12 years.

A specialist in business management and administration, Luce holds bachelor and master of arts degrees from Stanford University and is a graduate of the Indiana University School of Savings and Loan.

He served in the U.S. Infantry in Europe and the occupation of Japan from 1946 to 1948. He was awarded a Bronze Star.

Luce, a native San Diegan, is past president of the San Diego Downtown Association and the University Club of San Diego, and a member of the American Savings and Loan Institute. He is presently a director of the San Diego Symphony Association.

He and his wife, Karen, have two sons and a daughter.

The first of recent new appointments to the California Highway Commission is **Fred C. Jennings,** 58, of Riverside, appointed to replace the late James A. Guthrie.

Jennings has been president of a real estate firm in Riverside since 1958 and for 12 years before that was owner of an automobile agency.

He is a member of the board of directors of Security First National Bank in Los Angeles and the Southern California Water Coordinating Committee.

He has been a member of the board of directors of both Riverside Community Hospital and the Riverside Board of Public Utilities, and served as chairman of the Citizens Advisory Committee to March Air Force Base.

Jennings is married and has two children.

Jennings was appointed to fill the unexpired term of James A. Guthrie, editor emeritus of the San Bernardino *Sun-Telegram*, who died last August.

Moon Lim Lee

Vernon J. Cristina

Highway Commission

THREE OTHER NEW MEMBERS

Another recent appointee to the California Highway Commission is **Moon Lim Lee,** 63, a businessman who long has been active in civic and highway association affairs in Weaverville, Trinity County. He replaces Roger Woolley of Rancho Santa Fe.

Lee operated a grocery business in Weaverville from 1922 to 1948 and since 1949 has been owner of an appliance firm.

He attended school in his native Trinity County and has been active in civic affairs in that area including the Weaverville Chamber of Commerce. He is a director of the Highway 299 Association, the Trinity County Recreation Park and Parkway District and the Weaverville Sanitary District.

Lee is past president of the Trinity County Historical Society, a member of the Chinese Historical Society of America and serves on the Advisory Committee of the California National Highway Week Committee.

Lee is married and has one daughter.

Appointed to the Highway Commission at the same time as Lee, was **Vernon J. Cristina,** 51, of San Jose, head of a warehouse company and active for many years in the transportation field. He succeeds Joseph Houghteling of Atherton.

From 1937 to 1948 he operated and managed orchard properties and a general store in San Benito County.

Cristina attended San Jose High School and graduated from the University of Santa Clara with a major in political science.

He has been active in numerous civic activities. He is past president of both the Santa Clara County Transportation Club and the Santa Clara County Truck Owners Association. He is also a member of the Board of Governors of the California Truck Owners Association.

Cristina is married and has three sons.

STORM HAVOC IN Dist. 6

By
Ed Tiedemann

1

5

2

4

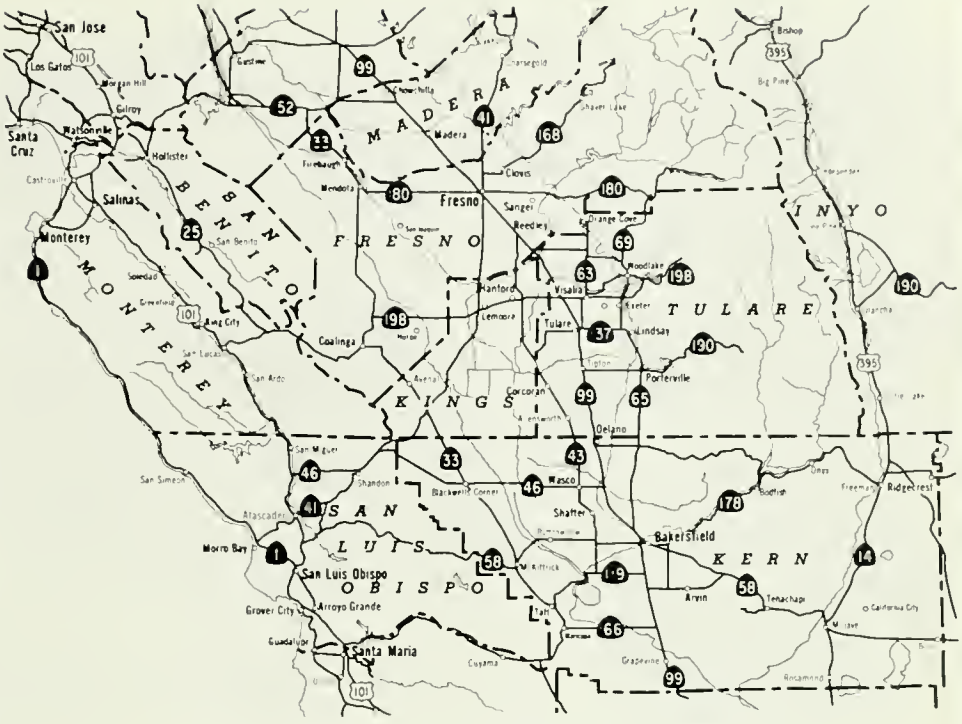
3

Photos clockwise from top: (1) Widespread clogged culvert damage is typical of such storms. Pipe becomes clogged by debris and water rushes across paving, washing out road. (2) Although water rose over deck, this bridge over Tule River on Route 190 east of Porterville did not fail. (Photo courtesy of **Tulare Advance Register**) (3) Crane removing debris backed up against Clear Creek Bridge, Route 178, Kern County. (4) Typical damage to bridge understructure. (5) Destroyed section of Route 180 in Kings River Canyon, near national park boundary. Engineers used motorbike to travel road to assess damage, "mule hauling" it over washed out places.

Record flood—5,000 acre-feet per hour—80,000 second-feet—peaking at 100,000 second-feet—these and other terms filled the San Joaquin Valley newspapers during the first week in December. They were used to try to describe the torrential rains and devastating floods that occurred during that period.

To engineers, these terms are meaningful for use in formulas for determining sizes of dams, reservoirs, channels and bridges to handle quantities of water. To the layman who has never seen water in those quantities—even to those who have had the absolutely helpless feeling of being exposed to floods—it is very nearly impossible to relate these figures to known quantities.

STATE ROUTES SUFFER, COUNTIES MORE SO


San Jose
Los Gatos
Santa Cruz
Watsonville
Gilroy
Hollister
Salinas
Monterey
Carmel
Pacific Grove
Castroville
Soledad
Greenfield
King City
San Lucas
San Ardo
San Simeon
Atascadero
Morro Bay
Grover City
Arroyo Grande
Guadalupe
Santa Maria
Cuyama
Los Alamos
Gustine
Newman
Firebaugh
Mendota
Madera
Chowchilla
Fresno
Clovis
Sanger
Reedley
Dinuba
Selma
Kingsburg
Orange Cove
Parlier
Woodlake
Exeter
Lindsay
Porterville
Tipton
Visalia
Tulare
Hanford
Lemoore
Corcoran
Coalinga
Huron
Avenal
Delano
McFarland
Wasco
Shafter
Bakersfield
Arvin
Tehachapi
California City
Mojave
Rosamond
Lancaster
Palmdale
Lake Isabella
Kernville
Onyx
Bishop
Big Pine
Shaver Lake
Huntington Lake
Friant
Millerton Lake
Auberry
Prather
Piedra
Sanger
Squaw Valley
Lanare
Riverdale
Kettleman City
Avenal
Stratford
Lemoore Naval Air Station
Laton
Kingsburg
Traver
Exeter
Ivanhoe
Woodlake
Lindsay
Strathmore
Porterville
Terra Bella
Ducor
Richgrove
Earlimart
Pixley
Tipton
Alpaugh
Allensworth
Delano
McFarland
Wasco
Shafter
Bakersfield
Arvin
Tehachapi
Edison
Maricopa
Taft
Buttonwillow
Famoso
Lost Hills
Kern
Semitropic
Stockdale
Oildale
Rosedale
Greenfield
Weedpatch
Lamont
Arvin
Edison
Tehachapi

Above left: Section of Route 178 along Kern River west of Bodfish shows culvert failure, rock slide, water and debris on pavement, all problems for the maintenance crews. Two photos above right: "During" and "after" views of North Fork Tule River Bridge on Route 190, at Springville (upper right courtesy of **Porterville Evening Recorder**).

The county lost 13 bridges and damage to and loss of miles and miles of roads. Johnsondale suffered isolation for days, and, with the drinking water supply limited to that which could be brought in from the outside and sanitation facilities destroyed, there was fear of epidemics. County health officials were flown in and the threat curtailed. Springville, and as noted earlier, Three Rivers were the other communities hit hardest in Tulare County.

The town of Woodlake was almost isolated when State Routes 216 east and 69 were closed. Route 216 west was kept open under control. The town of Exeter was threatened when Yokohl Creek broke over its banks, flooding the nearby orchards. No one could remember this happening before.

Fresno County

Major damage to state highways in Fresno County was concentrated on Route 180 through the Sequoia National Forest. East of General Grant Grove, the bridge at Ten Mile Creek was damaged so severely that the 35-year-old structure will probably be replaced. The Kings River preempted the highway alignment in this area and will have to be brought back into its normal channel. Four clamshells were kept busy during the storm at various locations clearing debris away from bridges.

Estimates of cost of restoring this route range to $550,000, depending on the amount of bank protection work required on the river banks.

In the valley west of Route 99, Route 43 in Tulare County was closed for about a week when the Tule River spilled over its banks; Routes 33 and 41 were blocked by mud flows for a couple of days near Kettleman City. A rancher, a veteran of 70 years in this area, said this was the heaviest rainfall he had ever seen there. Route 198 west of Coalinga was closed for two days because of mud and rocks on the highway.

The lower areas of Kern, Tulare and Fresno Counties would have been subjected to far greater flooding and very extensive property damage had it not been for the Isabella, Success and Terminus, and Pine Flat Dams and Reservoirs. It is estimated that $150,000,000 damages in Kern and Tulare Counties alone were averted by the first three of the dams listed above. The communities above the dams took the brunt of the storm. Water systems and wells were either washed away or contaminated by the rampaging floodwaters; warnings were issued to boil drinking water. Houses and mobilehomes were swept from their foundations and parking places. Kernville alone lost 115 mobilehomes, with another 110 damaged.

Sequoia National Forest suffered over two million dollars in damage to roads, trails, bridges and campgrounds. Rainfall measurements for the storm included 19.45 inches at PG&E Forks on the Tule River, 30.49 inches at Johnsondale, and 35 inches at Wishon Station. Fortunately, damage to natural resources was relatively moderate. Although high winds toppled trees which will total some 14 million board feet of lumber, the Forest Service estimates that about two-thirds of this timber may be salvaged next spring. Pending approval of requests for funds to repair damaged areas presently available funds will be used to remedy situations affecting health and safety.

CALIFORNIA highway needs

Interstate 80 over the Sierra Before and After
Renovated to Freeway Standards in 1964
Traffic Increases since Renovation:

Automobiles	23%
Trucks	35%
Buses	10%

O SAVE MANY LIVES.

Speed Highway Building

LIFORNIA, MORE THAN any area the world, lives on wheels. The gth of the state and its complex tropolitan developments are factors t continually build the volume of hway traffic.

Strong Support For Freeways

The County Supervisors Association of California, through its board of di-

Chamber Fears Fund Tieup to Delay Freeways

Full Development of Routes Pushed Despite San Francisco Problem

Full development of the San Diego, Riverside and Orange Freeways has been urged by directors of the Orange County Chamber of Commerce despite the possibility of tieup of federal interstate funds.

The direc

Simi Valley Residents to Fight Freeway Delay

Morgan Hill Joins The Campaign

Road Funds Dim Disney Prospects

Question Is not to Build Freeways but to Get Them Built in Time

Cutback seen in county road building funds

By MARTIN SALDITCH
Enterprise Capitol Bureau

SACRAMENTO — Riverside County faces a cutback in state road construction as an indirect result of

'Hazardous Route'

Highway 104 Funds Urged

Fight For Sierra Road Is Pledged

Contra Costa Asks Freeway Start on Route 17

ilroy 101 Bypass Needed Now

lonterey County Road Costs ise $1 Million Last Fiscal Year

BH Freeway Badly Needed

U.S. Cutback On Highway Funds Hit

Get Show on Road!

uncil Urges Haste on Devore Freeway

NTARIO — The City of Ontario its the California Highway Comsion to hurry and build the De- Freeway.

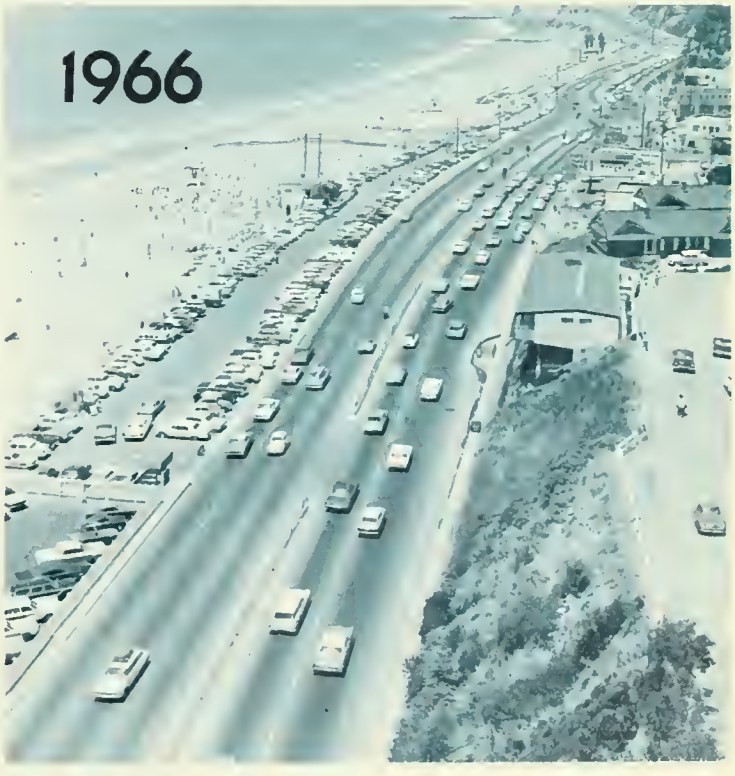
he City Council

ber 1 expec speed sectio

Drivers Will Have Long Wai

For Improvements On US50

California's Continuing Problem



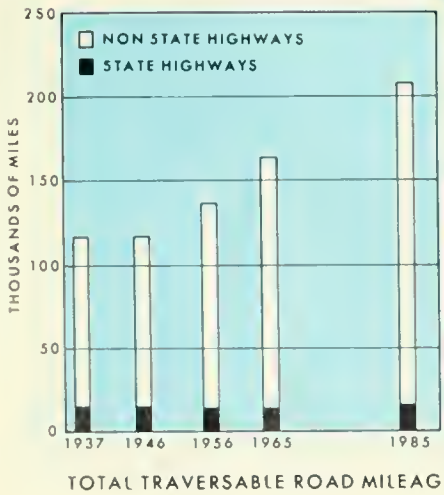
Although the overall situation changes, some traffic patterns remain constant. These two photos of the same location on the Pacific Coast Highway, near Santa Monica, were taken 36 years apart. During that period, the conventional two-lane highway was renovated by the addition of more lanes and today's traffic flows smoothly but the thoroughfare still is inadequate. A freeway is needed now and this increases each year. The various alternate plans under consideration for freeway construction will all require the expenditure of several million dollars per mile.

The Situation Today

During the 1966 Christmas weekend, the people in California traveled more than 662,000,000 miles on California's total road network. Approximately 10,000,000 vehicles were in operation and they traveled upon 2,700 miles of multilane freeways or expressways, 11,500 miles of conventional state highway and 150,000 miles of county roads and city streets and national roads.

The 2,700 miles of freeway at times verged on reaching the saturation point for they accounted for 223,000,000 of the vehicle-miles. The conventional state highways accounted for 115,000,000 vehicle-miles and the other roads the remaining 324,000,000.

Next Christmas, the number of miles driven and the number of vehicles that will travel in California will be even more impressive, for the state's vehicle population at that time will have been increased by a substantial number of trucks, buses and automobiles. If highway construction fails to keep pace with this gain during the next 12 months, it will result in a loss of time and money to California drivers and more important, some will lose their lives because of increased congestion and traffic hazards brought about by the greater number of vehicles that will be using the system.



TOTAL TRAVERSABLE ROAD MILEAGE

The continuing phenomenal growth of California's population, quadrupled since the 1930's, with an even faster rate of growth in numbers of automobiles is creating problems on urban and inter-urban freeways, as well as on city streets. Compounding the problems is the arrival in the state every day of several thousand new automobiles.

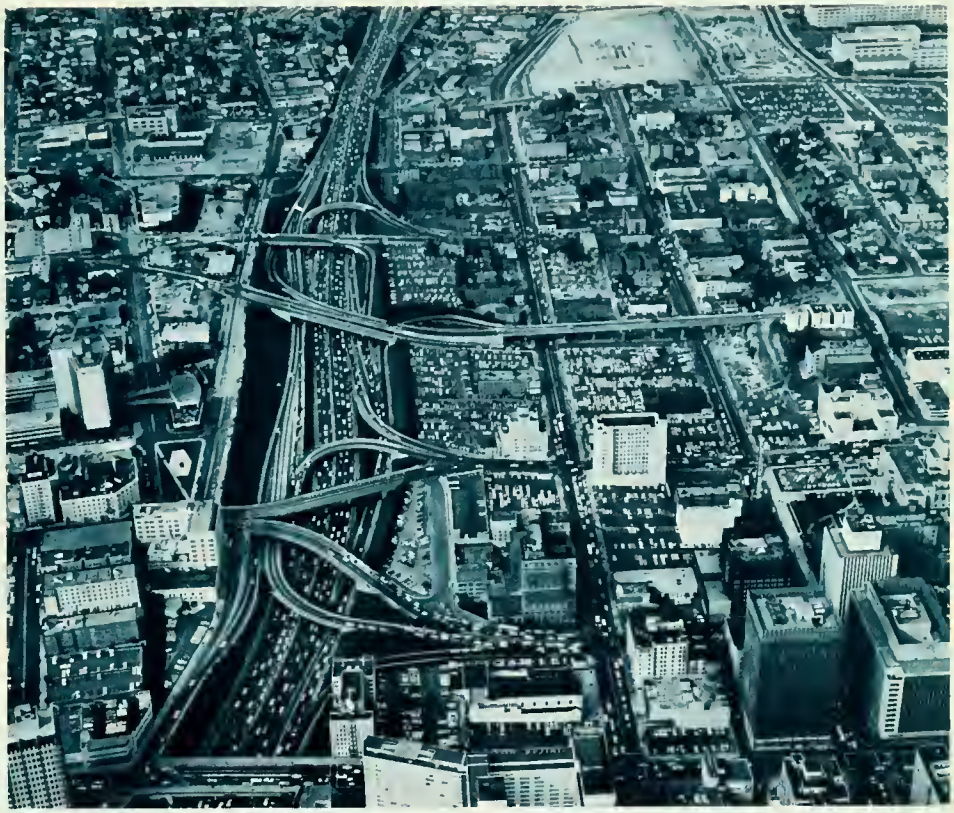
Bridge Left Harbor
US Re hway In s er tws
0 vehicles daily
f state lumber and
traffic ev t nee f he al communities To
Highway e u t m der ta ards between San
the Ore e a t $500 n wil be eeded. Dozens
he n in a recreat h hwa,s the tat are as dy in
f m ev iza ion

The Californian and His Automobile

HE IS ALMOST TOTALLY DEPENDENT ON IT

Granted, Californians drive more miles during a holiday weekend than at any other time, but, nevertheless, its economy is almost totally dependent upon rubber-tired vehicles so far as the transportation of people and goods are concerned.

A deep and lasting affinity has existed between the average California citizen and the automobile for many years. He seems to demand the independent mobility—the ability to go where he wants at his pleasure—that driving his own car provides, and he is more than willing to pay for it. He refuses to live in an environment that groups his home, place of work and shopping facilities all within easy walking distance of each other. He turns away from the use of mass transportation as a means of getting to work and even is reluctant to join in a car pool with fellow workers. He prefers to own at least two automobiles and for good reason. While he has one at work, the other is used by the rest of the family to transport the children to school and to permit his wife easy access to the thousand and one advantages and services that exist within the community—if she has convenient access to them.



Above: Hundreds of thousands of Los Angeles County workers travel daily up to 40 and 50 miles each way between their homes and their jobs. Below: The freeway seen crossing the upper part of the photo, combined with the expressway which passes over it, serve a portion of San Jose which two decades ago was a quiet scattering of residences. Greater San Jose, with its growing industrial complex, will soon rival San Francisco in population.

Rush hour at the San Francisco-Oakland Bay Bridge Toll Plaza

HE LIVES IN A BIG STATE

With few exceptions, California's metropolitan areas are attuned to individual transportation facilities, for rather than being a land where the environment is a vertical one such as that found in the larger cities of the eastern United States and where many people live in high rise apartments, in the Golden State there has been vast horizontal expansion with an accompanying very low density of population within a particular vicinity. Expressed differently, in California there are very few living in the same neighborhood who follow common traffic patterns. Therefore, until technology can provide a substitute that Californians will accept, the motor vehicle will remain the state's basic means of transportation.

One out of every 10 persons in the United States lives in California, and its 19,300,000 population continues to grow. It is basically an urban state, for research conducted in 1965 showed that 88 percent of its people live in urban areas. This was not always true, for at the turn of the century 47 percent of the people lived in the country. Since that time, there has been a gradual influx into cities, and by 1985 this trend will have reduced the rural population to only 11 percent of an estimated total population of 32,600,000 persons.

There were 9,900,000 motor vehicles registered with the California Department of Motor Vehicles at the end of 1965, or slightly more than 11 percent of all within the United States. No figures are available for the estimated national number in 1985, but in California research indicates that registrations will then approximate 20,000,000 vehicles.

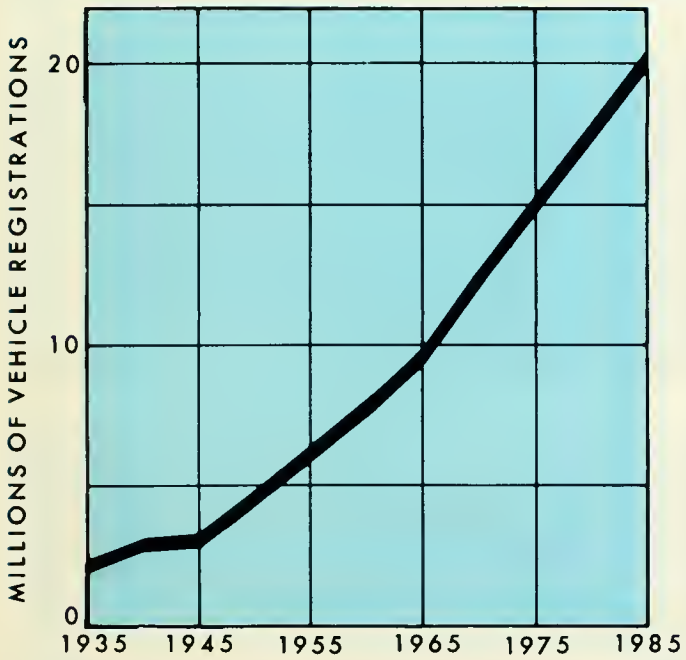
In 1965, 96,100,000,000 vehicle-miles were driven in California, approximately 11 percent of the national total. No national estimate is available for the year 1985, but the very conservative estimate for California in 1985 is 199,000,000,000 vehicle-miles.

Although this increase in people and vehicles will concentrate in urban areas, California ranked sixth nationally in rural population in the last federal census and, therefore, it is imperative that highway planning follow a balanced program concept that takes into consideration all elements of the population and provides total highway service to all California highway users.

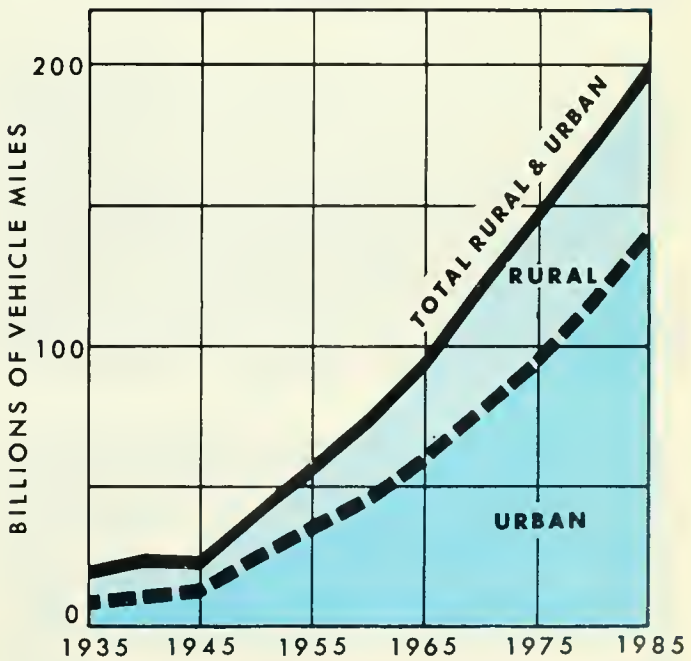
Recreation is a case in point. A recent study shows that recreation facilities in the vicinities of California's 14 metropolitan areas are now inadequate. The bulk of new ones that will be developed to meet current and future needs will be at an appreciable distance from the cities and the logical means of transportation between these sites and the cities is the motor vehicle. In this regard too, the State Department of Parks and Recreation as

(Photograph by Jon Wells, courtesy of Gross, Roberts and Rockey)

WITH MANY AUTOMOBILES



VEHICLE REGISTRATION



VEHICLE MILES TRAVELED

Highway Needs Are Immense

a part of its study noted that, with the exception of walking, driving for pleasure is by far the most popular form of California outdoor recreation.

The vehicle transportation needs of California have been and are continuing to be carefully evaluated under a comprehensive planning process.

The State Legislature has established the California freeway and expressway system, which is a master plan of development for meeting transportation needs over the major State highway routes. The plan established in 1959 is designed to serve and promote both the present and future economy of the state and the welfare of the people. The now partially completed system will eventually consist of 12,500 miles of controlled-access highways and is intended to connect and serve major areas of population, provide appropriate access to the various regions of the state and facilitate the enjoyment of the state's many scenic and recreational facilities.

Because of the many needs and the ever-present funding limitations in the total highway program, most careful evaluation is given to the type of development to be afforded each route and the priority or importance of the particular project.

Where traffic volumes and other factors warrant, freeway facilities are provided because they have clearly been shown to be the safest and most effective form of roadway facility. In many other situations, conventional highways are reconstructed or partial access control highways are provided. Through careful coordination with local officials and a system of meetings and discussions with interested groups throughout the state, all construction needs and priorities are systematically examined.

An extensive spot improvement program is carried out in situations where financing is not available for total reconstruction.

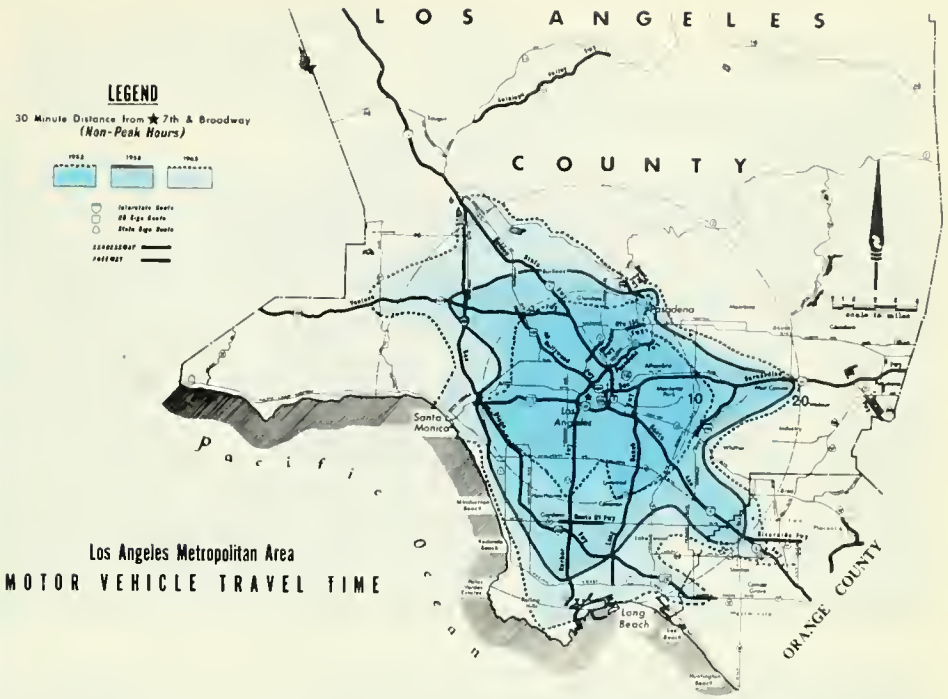
Under this program, accident concentration locations are readily determined and necessary remedial action taken. Considerable emphasis is placed on minor improvements such as curve corrections, widening of pavement, and the installation of guardrail, channelization and signal lights.

Safety roadside rests and provisions for a special scenic highway system round out the state program.

A "select system" of county roads and city streets has been established to serve the needs of local jurisdictions. This system consists of 38,500 miles of heavily traveled local roads and streets. Financing is provided by a share of the state gas tax and local funds. The state maintains general control of the system by approval authority as to additions, deletions, roadway design and actual expenditure of funds.

The federal aid secondary and urban extension programs further assist in the vast job of providing an adequate local road system to meet ever increasing needs.

MUCH HAS BEEN DONE . . .



Although the Greater Los Angeles freeway system is still incomplete, it is gradually cutting down travel times in the area. Note how each freeway now in service greatly extends the distance a driver can travel in a set period of time, versus the distance he can travel in the same time on conventional highways and city streets.

Comprehensive urban transportation studies are now underway or definitely planned for the state's 13 major urban areas (50,000 population or more). These studies are being carried out under the provisions of the Federal Aid Highway Act of 1962 and will provide a continuing evaluation of overall transportation needs and will develop guidelines as to means of fulfilling these needs. These comprehensive studies take into consideration all facets of community and transportation planning and because of the high degree of local participation, will be of great assistance in the development of feasible, practical solutions.

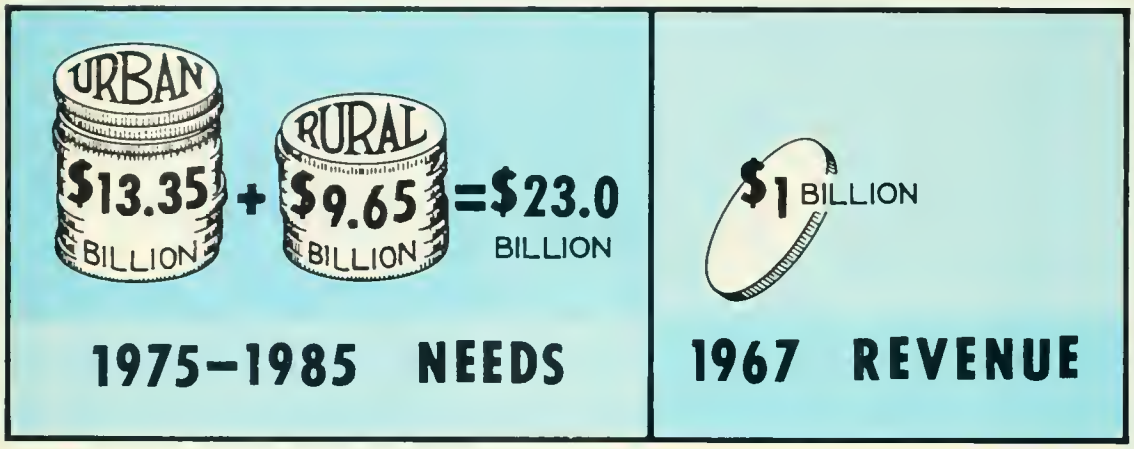
The Los Angeles freeway system, although only partially completed, is at the present time the largest and most effective rapid transit system ever devised. The San Diego Freeway, which is only a 50-mile segment of the system, carries over three-quarter million people on an average day. The Harbor, Santa Ana, and Golden State Freeways within the metropolitan area each carry well over half a million persons. Other segments also carry high volumes.

The system too has the dual role of providing the means of transporting the predominance of freight originating or terminating in the vast Los Angeles metropolitan area. An analysis made in 1962 showed that the San Bernardino Freeway, for example, carried an average of 110,000 tons per day, or the equivalent of over 1,800 box cars or 11 Liberty ships. The Santa Ana, Hollywood and Harbor Freeways were also high-volume carriers. On an overall basis the Los Angeles system volume is now estimated at 3,300,000,000 ton-miles per year.

The need for additional freeway miles is increasingly important. Social scientists declare that by 1985 there will be a single urban area extending from north of Los Angeles past San Diego and on to the Mexican border. The people who will reside there probably will be like the ones who live there today—members of an automobile-oriented society who depend mainly on rubber-tired vehicles.

While the southern California area provides the most striking illustration of urban growth and consequent needs, this same general theme of growth and needs is true for the many other urban areas of the state.

1975 - 1985 $23,000,000,000



TO SOLVE MANY PROBLEMS

The needs both state and local for the 10-year period between 1975 and 1985 are of particular concern at this time. Based on today's prices, it will cost approximately $16,000,000,000 to pay for construction, rights-of-way and engineering during that decade. However, land values in California are going up and the general cost of construction is keeping pace. Cost projections, based on statistics compiled over many years, indicate that today's figure will be approximately $23,000,000,000 when the bills actually are paid. This is based on the assumption that the present program level will continue up to 1975.

Future needs in California are determined in a conservative manner and they include only those factors that must be considered to ensure a system that can provide basic service to the traffic flow of the future. Only those additions that this future traffic will require are included in the 1975–1985 period.

In making the estimates of roadway deficiencies due conideration has been given the fact that other forms of transportation will be carrying their predicted share of the load.

Below: Although commonly thought of as a single city, Los Angeles is only the heart metropolis of a complex of some 120 cities covering 9,000 square miles, with a population of 9 million people. Here, where almost all the usable land in these 9,000 square miles has been built upon, is also the world's greatest concentration of motor vehicles. Because almost all of California's urban areas have been developed in modern times since the automobile came into popular use, private cars are used virtually exclusively for transportation, and trucks for the movement of freight. Los Angeles County alone has more than 4 million registered motor vehicles.

SOME OF THE PROBLEMS . . .

This narrow section and bad alignment in the northwestern part of the state is typical of the hundreds of such deficiencies which still exist not only on secondary state routes, but on major federal aid routes similar to US 299

Typical congested street in a major through route in a major Central Valley city

An older freeway section in Los Angeles now carrying more than 150,000 vehicles daily.

Many Californians today have vacation or retirement homes in the desert, the mountains, and along the seacoast. Trip travel between urban areas and these new developments is heavy, particularly on weekends and in season. Shown is a typical such development which offers 3,500 building lots, but is 23 miles from the nearest state highway. It is currently serviced by a substandard county road.

A major federal aid route [illegible] summer with truck [illegible]

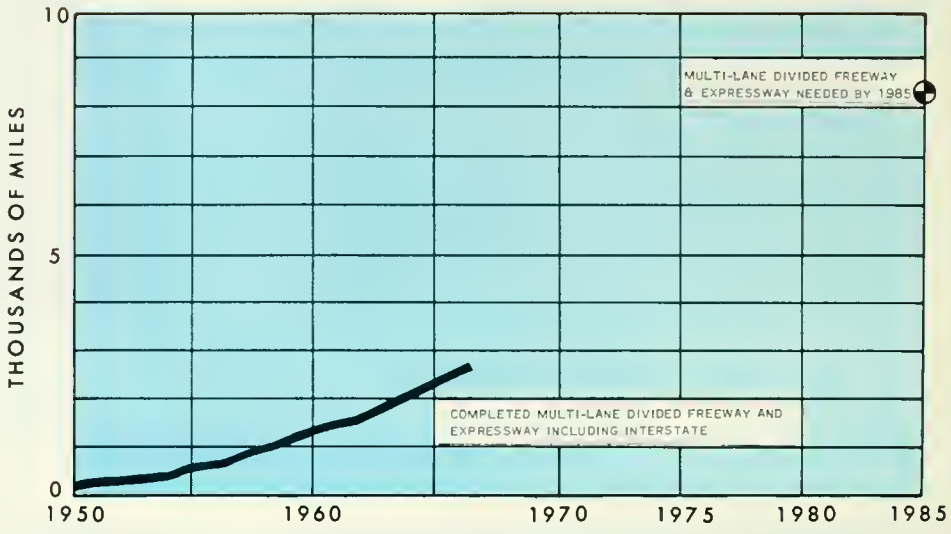
[illegible] exceed [illegible] such as this [illegible]

The Future

Much of the specific planning required to accomplish the work that should be done during the 10-year period under discussion has been accomplished and other phases are now underway. The State Legislature has identified the termini of all state highways, and the locations of the routes that many of them will follow have been formally adopted. Like the state, each city and county has a competent engineering staff that is charged with identifying and correcting their needs.

California now spends almost one billion dollars per year in improving roadway facilities with about two-thirds of this amount devoted to state highway development. The amount available for state highways alone provides for nearly 250 miles of new freeways each year plus a substantial mileage of new and improved conventional roadway facilities. Additionally hundreds of miles of roads and streets are constructed or improved each year with funds available at the local level. This improved roadway mileage barely takes care of increasing needs. Deficiencies exist in almost all areas of the state, and because of financial limitations some highly desirable projects must be put off for future years. In this regard, it is estimated that even if spending continues at the present level until 1975 an additional $23,000,000,000 will be required to meet needs in the 1975–1985 period.

If the California highway system is to continue to operate effectively, other *planned* segments must be added to handle increasing demands. Any significant decrease in the construction of the freeways, expressways, conventional highways, or county roads and city streets will immediately handicap the movement of people and the things they need. If such a slowdown were to continue over an appreciable period of time, it could result in stifling their economy and stagnating the most mobile society in the world.



FREEWAY PROGRESS

The parking area at Disneyland on a holiday weekend. This attract[ion] in its lots. In recent years amusement parks similar to Disney[land], [and] cultural centers are generating new transportation prob[lems]. A[n] problem is the Californian's tendency to travel hundreds of mi[les] camping in state and national parks and forests, skiing and bo[ating]. [Much] carried on trailers, of which the state now has more than a q[uarter] traffic problems.

California Highway Facts

MILEAGE—ROADS, STREETS, HIGHWAYS

Present	164,248 miles
Rural	124,701 miles
Urban	39,547 miles
Comprised of	14,215 miles state highways
	36,980 miles city streets
	70,089 miles county roads (maintained)
	11,258 miles county roads (not maintained)
	31,706 miles national roads
Estimated 1985	207,500 miles (16,200 miles state highways)
Rural	127,051 miles
Urban	80,449 miles

MOTOR VEHICLE REGISTRATION (ALL VEHICLES)

1966—California—10.9 million—Rank, first
(Percent of nation—approximately 11%)

1985—(Estimated) California—20.0 million

MOTOR VEHICLE TRAVEL—VEHICLE-MILES

1965—California—96,100,000,000 vehicle-miles
Rural—36,100,000,000
Urban—60,000,000,000
(Percent of nation—approximately 11%)

1985—(Estimated) California—199,000,000,000 vehicle-miles
Rural—60,400,000,000
Urban—138,600,000,000

Of the 1985 total, 86 billion vehicle-miles will be traveled on state highways annually. Of this, 37.9 billion will be on the Interstate system alone.

TOTAL NEEDS ALL HIGHWAYS, ROADS AND STREETS—$23 BILLION

Rural—$9.65 billion
Urban—$13.35 billion

POPULATION

1966—California—19.3 million—Rank, first
(Percent of nation—approximately 10%)

1985—(Estimated) California—32.6 million

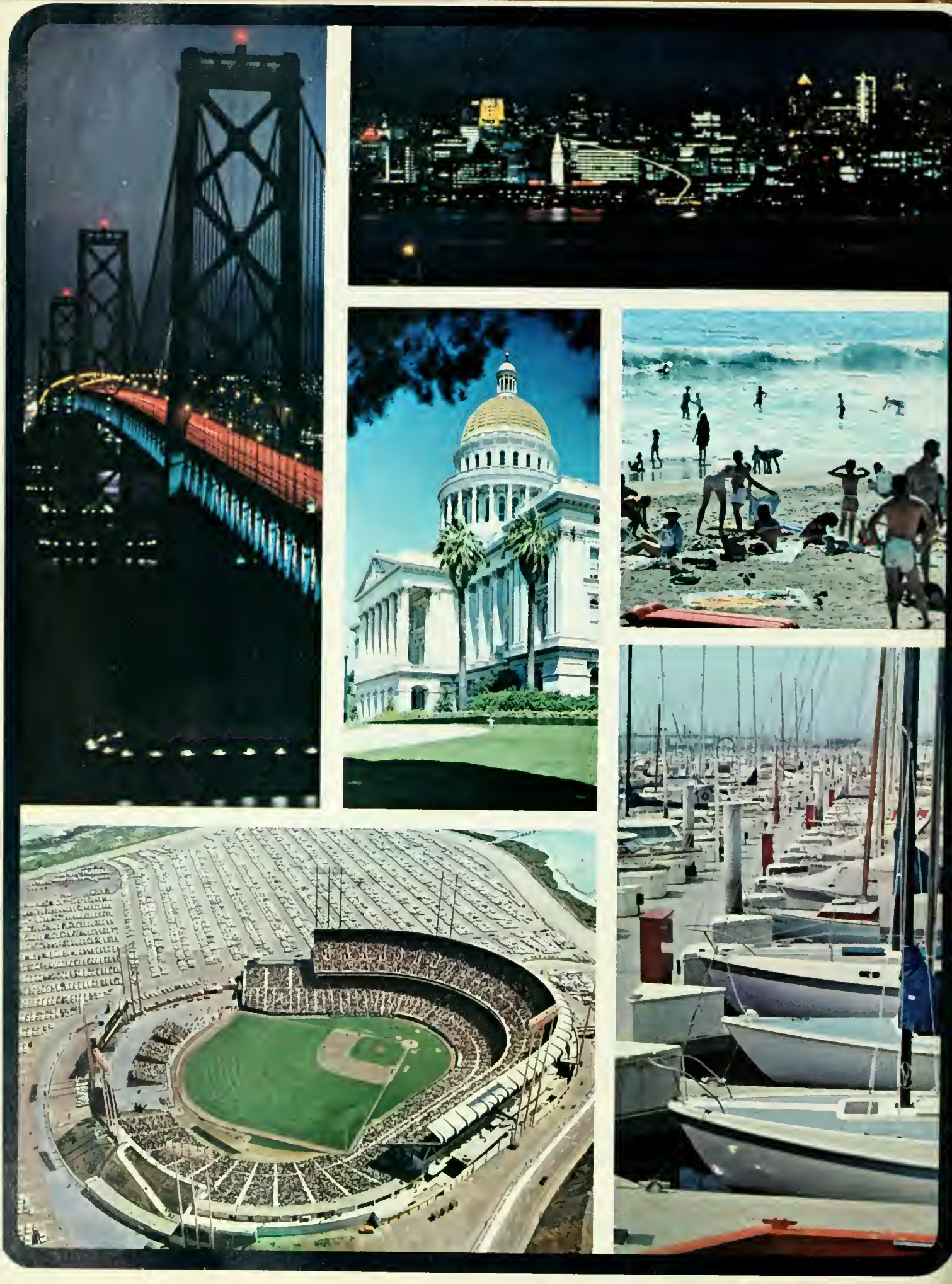
Eighty-eight percent of the population of California lives in urban areas. In 1985 it is estimated that 29 million people or 89 percent will live in urban areas.

MILEAGE—FEDERAL AID SYSTEMS

Interstate highway system		2,165 miles authorized
Completed	1,087 miles	
Under construction or budgeted	579 miles	
Total	1,666 miles	
Other federal-aid primary		7,623 miles authorized
Federal-aid secondary		12,667 miles
(State, 3,554 miles; local, 9,113 miles)		

PROGRESS ON CALIFORNIA FREEWAYS AND EXPRESSWAYS

Completed multilane divided state highway		
Freeway	2,046 miles	
Expressway	661 miles	
	2,707	2,707
Multilane divided state highway under construction or budgeted		
Freeway	720 miles	
Expressway	64 miles	
	784	784
		Total 3,491



View of new highway, south end looking north.

Highway to the Space Base

By R. R. Crandall

COOPERATIVE EFFORT CREATES A BEAUTIFUL ROAD

The general said, "We must be able to evacuate this base in nine minutes."

This remark initiated a system of expressways for the great Vandenberg Air Force Base, located on the shores of the Pacific Ocean, north of Lompoc and southwest of Santa Maria, in Santa Barbara County.

Until recently, only two narrow, winding ribbons of asphalt passed through the old Camp Cooke area, but today's growing space center is now served by the best in modern highway facilities. With the opening of the Vandenberg Shortcut Number Two modern highway service is now completed to the space age center, where recently a new two-million-dollar contract was awarded to initiate a space probe program.

Lompoc, once a quiet nearby village of 4,000 souls, has become a thriving, growing city of 24,000, and Santa Maria has expanded until homes are springing up on pastureland miles from the city center. Most of the base's 20,000 workers travel from these two cities early in the morning and return late in the evening. The scramble at the base gate at these times resembles an exodus from a Dodger baseball game at Chavez Ravine.

An exchange of ideas from the Santa Maria Chamber of Commerce, the Bureau of Public Roads, the county road department, the VAFB engineering and personnel staff, and personnel from the District 5 engineering department cleared the way for the production of contract plans. This was a complicated project, financed by the federal government, administered by the U.S. Bureau of Public Roads, designed and constructed under the supervision of the State Division of Highways, reviewed by the staff of VAFB, and maintained by the County of Santa Barbara, but everything evolved in excellent form.

Photos left to right clockwise: (1) Where cuts were necessary slopes were made 4 to 1 to blend into terrain. (2) Section through swamp area. Beneath surface ground was almost all water, with material about of consistency of thin gruel to depth of 40 feet. More than 50,000 yards of sand were required to establish road foundation on this half-mile stretch. (3) Loop connection with recently realigned Route 1. (4) At this low pass, a new view spreads before the traveler's eye. (5) Across the road, believe it or not, was one of the borrow sites. Now, smoothed and graded to fit into the surrounding slopes, and seeded with ryegrass, it becomes a part of the natural landscape. (6) Map of area shows new route to Vandenberg and superseded San Antonio Road. Almost simultaneously, the new section of Highway 1 shown was opened.

Last October, at eight in the morning, it was not uncommon to see cars lined up bumper to bumper for five miles, the hundreds of occupants waiting impatiently to get to work at the base. Several times when fog was present, a series of telescopic rear-end collisions occurred.

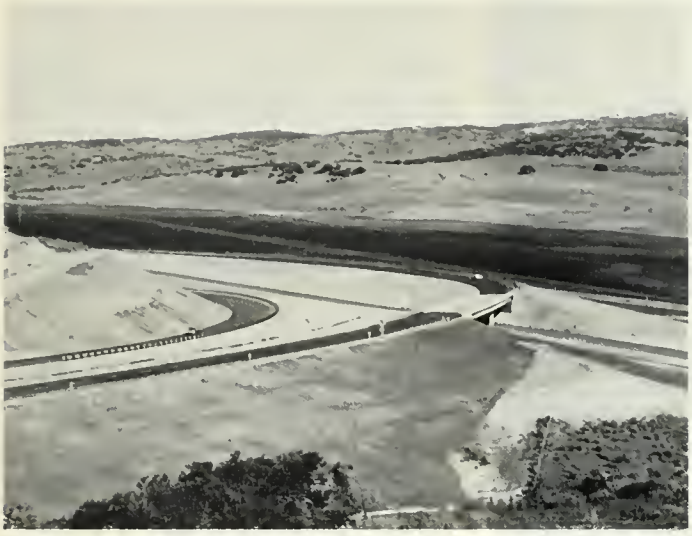
Today, since dedication of the new expressway on November 2, 1966, a worker from Santa Maria can leave 15 to 20 minutes later in the morning and still arrive on time for work. The 6.5 miles he doesn't have to drive, plus the better entry conditions all go to make for a safer drive and a happier and more relaxed traveler.

In addition, in line with today's practices, the aesthetic values of the highway were protected by shaping tops of cuts to look like natural hills, by flattening slopes to resemble original terrain, by concealing ditches from the driver's view, by using rounded earth-colored poles for a camouflaged fence, and by saving as many beautiful oak trees as possible. To restore beauty where new construction made unavoidable scars, an extra heavy application of straw and seed on the sandy slopes was used and then to further enhance the beauty of the terrain, Texas bluebonnet seeds were scattered. (For those who would question the use of an out-of-state "native," it should be explained the Texas bluebonnet is almost identical with one of California's lupines, is as well adapted to the California climate, germinates better, is a more vigorous plant, and has the added advantage that seeds are available in quantity).

Not forgetting the requirements of the *Planning Manual*, a "built-in" maintenance department was constructed. To give the maintenance men a chance to clean up sand that might trickle down the cut slopes, a six-foot bench at dike level to act as a catch all was provided on each side of the highway. Ditches, where subject to erosion, were lined with tinted air-blown mortar. Distracting markers, signs and guardrails were kept to a minimum. All pipes were placed so as to maintain a self-cleaning condition.

Not everything was "peaches and cream." There were a few problems in design. A swamp area of about a half-mile in length gave some trouble when headquarters reported that the material in this area was undoubtedly the worst that had ever come to the lab for testing. It was so bad that it had to be moved during construction, and it was.

It was a challenge to design the Vandenberg Overcrossing with a graceful loop meeting the Route 1 Freeway at a design speed of over 50 miles an hour, and to endow a merging connection with a feeling of security. Even though the driver rises to some 30 feet above natural ground, the shape of the loop area, the flatter-than-normal slopes, the wide-open view and wide medians afford the feel-

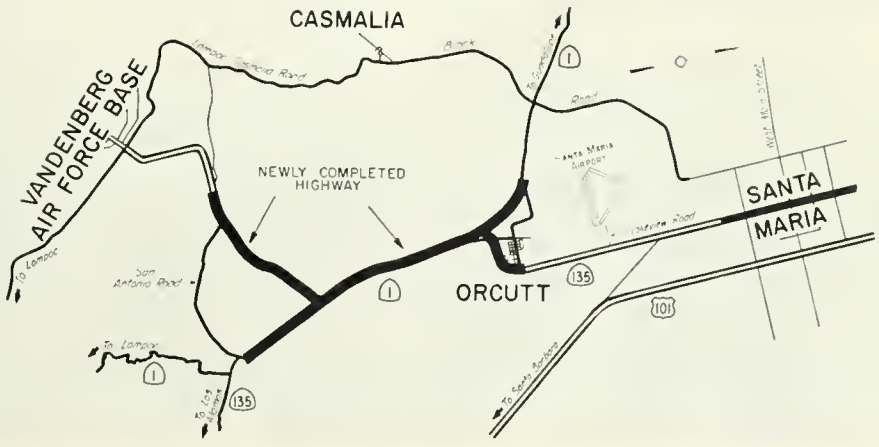


ing of security essential for a well-designed highway.

Construction personnel did an excellent job of putting the plans "on the ground" and then adding touches here and there to dress up the countryside so that it is now especially beautiful. Particularly, they were remarkably successful in leaving two borrow sites in a natural-looking condition.

Ground water was encountered in the largest cut. The problem was solved by the use of perforated metal pipe underdrains which still conduct a large quantity of water.

If the reader would like to see some of the finest stately oak groves of California, wildflowers of many colors and forms, and experience a truly pleasurable tour, a drive over this new highway is strongly recommended. As a bonus, it is possible that one may even see a mighty missile rise from the earth and soar grandly down the Pacific range.



Bartlett Award for J. C. Womack

The "George S. Bartlett Award," one of engineering's highest, has been awarded to J. C. Womack, State Highway Engineer and Chief of the California Division of Highways. The award is given annually to the person who has made the most outstanding contribution to highway progress.

In presentation ceremonies at the national conference of the American Association of State Highway Officials in Wichita, Kansas, on November 29, A. E. Johnson, executive secretary of AASHO cited Womack's achievements in leading California's highway and freeway program, terming it "the most advanced in the nation."

Johnson pointed to the State Highway Engineer's successful efforts to beautify America's roadways, paying particular attention to Womack's example in promoting highway aesthetics.

The George S. Bartlett Award, named for the individual who first advocated paved roads in the United States, was instituted in 1931. It is presented annually to a member of the American Association of State Highway Officials, the American Road Builders' Association or the Highway Research Board.

A native of Emmett, Idaho, Womack was educated in Seattle and attended the University of Washington. He served as a second lieutenant of field artillery in World War I. His engineering career began in Oregon and Washington in 1922 on location and construction work for the U.S. Bureau of Public Roads.

Joining the California Division of Highways in 1929, he was assigned to the Marysville office, where he served successively as resident engineer, district maintenance engineer, engineer of surveys and plans, district construction engineer, and assistant district engineer. In 1948 he moved to Headquarters Office in Sacramento as planning engineer for the division.

In 1955, Womack was promoted to Assistant State Highway Engineer—Planning, and in October 1959 was advanced to Deputy State Highway Engineer—Engineering. In December 1959, he was appointed State Highway Engineer.

Womack is past president of both the American Association of State Highway Officials and the Western Association of State Highway Officials. He is a member of the American Public Works Association, the American Society of Civil Engineers, the American Concrete Institute, the American Society of Photogrammetry, the Commonwealth Club of San Francisco, and the Elks.

He is currently serving on the executive committee of the Highway Research Board, National Academy of Sciences; and as vice president of the American Road Builders Association.

As State Highway Engineer for California, Womack is responsible for administration, planning, improvement, construction and maintenance of about 15,000 miles of state highways plus some related functions in connection with local roads and streets. The State Division of Highways has about 18,000 employees, with an annual budget of almost a billion dollars.

For the past 17 years, and especially since his appointment as planning engineer in 1948, Womack has been closely identified with California's long-range highway improvement programs, with emphasis on freeway development. California now has about 2,100 miles of full freeway in operation or under construction. California's adopted routings for freeways come to more than 7,300 miles, or well over half of the mileage for the state's 12,500-mile freeway and expressway system designated by the Legislature in 1959 after a two-year pioneering study by the Division of Highways.

In addition to his California work, Womack has served as consultant to two foreign governments. He assisted with a study of highway deficiencies for Haiti, and with a route study between Tokyo and Kobe in Japan. He has also served as special consultant on construction problems in Indonesia.

In 1963 Womack was selected by the American Public Works Association as one of the nation's "top 10 public works men of the year."

Governor's Design Award

THREE OUT OF FOUR IN TRANSPORTATION FIELD

In the Governor's Design Awards contest for 1966, the California Division of Highways won three of the four certificates given for "significant design in the field of transportation." One was for a bridge, the Cold Spring Canyon steel arch in Santa Barbara County; another was for the design of the San Diego-Santa Monica Freeway Interchange in Los Angeles; and the third was for the design of the Interstate 80 Freeway over the Sierra Nevada.

The presentations were made by the Governor on December 28 in Pasadena. Nathaniel A. Owings, chairman of the awards jury, acted as master of ceremonies. Other members of the jury were Mrs. Helen Reynolds, president, California Roadside Council; Allan Temko, Center for Planning and Development Research, University of California, Berkeley; Sam T. Hurst, dean, School of Architecture and Fine Arts, University of Southern California; Dr. Harry Ashmore, Center for the Study of Democratic Institutions; Cesar Pelli, director of design, Daniel, Mann, Johnson and Mendenhall; and Professor T. Y. Lin, Department of Civil Engineering, University of California, Berkeley.

Awards were given in the categories of urban buildings; public buildings; educational, cultural and religious buildings; industrial projects; commercial service facilities; planned community; transportation facilities; rehabilitation (of buildings or neighborhoods); conservation; social improvement; landscape; and leadership (environmental).

Attending for the Division of Highways were J. E. McMahon, state bridge engineer, representing J. C. Womack, State Highway Engineer; and Tom Lammers, representing District 7, accompanied by Prescott Reed and Marilyn Reese. District Engineer Robert J. Datel represented District 5, and H. F. Sherwood District 3. Marvin Shulman and George Hood of Headquarters Bridge Department also attended.

Photos, top to bottom: The three certificates. Split section of Interstate 80 in the Sierra Nevada. San Diego-Santa Monica Freeway Interchange, Los Angeles. Cold Spring Canyon Bridge, Santa Barbara County.

STUDY
SHOWS DRIVERS ARE NOT
EASILY REGIMENTED

Installing a tape-switch indicator for recording speeds and time of day. More than 85,000 recordings were used in compiling data for study.

Minimum Speed Limits

By
Norman Wingerd

When the Legislature in April 1965, by House Resolution No. 133, directed the Division of Highways to undertake a study of the value of establishing minimum speed limits for each lane on state freeways, it seemed an interesting project, which might offer considerable benefit to California drivers.

The report on the results of the carefully documented tests at four locations in the state shows that quite the opposite result might be expected. The motorist reacts to such close regimentation, but not in the intended fashion.

Where the signs indicating minimum lane speeds were posted, drivers who normally would travel at middle-range speeds in the slower lanes, apparently said to themselves, "Oh boy! I can make better time if I get over in the fast lane," and they would move over but continue to drive at the same middle-range speed. Apparently, just as everyone thinks he is a good driver, so everyone thinks it is the other guy who is holding up traffic. (Actually, the traffic engineers say that almost everyone in California is a reasonably good driver, for which they are thankful, but, as also every driver knows, everyone does not like to drive at the same speed.)

Actually, when traffic reaches a certain rate of flow, the midrange drivers are reluctant to move back and forth between the outside lane and the "passing" (left) lane every time they catch up with a slow vehicle. In other words, they don't like to "keep right, pass left," since it causes them to change lanes so often. Yet the fast drivers, who comprise a minority, expect the midrange drivers to do just this in order to avoid having to change lanes themselves (by passing on the right).

At the outset of the tests, the engineers conducting them were interested in exploring the following possibilities which from a logical viewpoint might have been expected:

- 1. Variations in speed of vehicles in each lane should be less. In other words, the lane controls would separate the traffic so each driver would be moving at a speed comparable with others in his lane. He would then be

content to stay in the lane, rather than change back and forth, a cause of many accidents. There would also be less "tailgating" by drivers discontented with the speed of those ahead of them.

- 2. Traffic should tend to increase in the right lane, and decrease in the left lanes. This would make better use of the right lanes, while leaving the left lanes free for faster moving vehicles, with once again less motivation toward lane changing.
- 3. Passing on the right should be lessened. Although passing on the right is legal where there are adequate lanes to permit it, and allows freer movement of traffic on multilane highways, it does make some drivers nervous to be so passed, and it irritates the fast drivers who have to change lanes in order to get around the slow ones.

Four study sites were selected for the tests: one four-lane, one six-lane, one eight-lane, and one where an eight-lane freeway narrows to six lanes. The latter actually served as two study sites.

The four-lane section was on Interstate 80 (Roseville Freeway) near Roseville. The six-lane section was on Interstate 80 near Dixon. The eight-lane section was on Route 11 (Harbor Freeway) in Los Angeles. The combined section was on Route 101 (Bayshore Freeway) in San Mateo County.

These sites were selected for the following reasons:

- (1) They have nearly straight alignment;
- (2) They have no sustained grades which would significantly affect truck speeds;
- (3) They have no high volume on- or off-ramps which would induce an excessive amount of lane changing, passing on the right, and below-normal speeds, and;
- (4) All study sites had overcrossings on which signs could be mounted.

The first three considerations create an atmosphere for high speeds. This was necessary for the validity of the tests, as design features which affected speeds would introduce an artificial element.

"Before" and "after" data was gathered at each of the study sites, with "after" data taken when the signs had

Two-lane test site, Roseville Freeway.

Three-lane test site, Bayshore Freeway.

Four-lane test site, Harbor Freeway.

Two photos below: Traffic analyzer vehicle, and interior view showing operator at recording machine.

been in place a minimum of two weeks. Speed, volume, and headway information was obtained with the use of the Bureau of Public Roads' "traffic analyzer," a recording device which prints numbers on a paper tape showing the speed of each vehicle, as well as the time of day when it passed, to the nearest one-third of a second.

Observations of more than 85,000 vehicles were made with this equipment for the purpose of the study. The timing device of the analyzer was frequently checked and calibrated by numerous comparisons with the calibrated speedometers of Highway Patrol cars through the trap. Stopwatch observations over a longer section were also used for comparison.

The lane-changing incidence and the incidence of passing on the right was obtained by a visual count and also from an analysis of time-lapse photography using 16-mm movie film taken at one frame per second.

It was learned early in the study that the minimum speeds used on the higher speed lanes would have to be very close to the maximum speed limit if they were to have any effect, because the so-called "slow drivers" were already traveling nearly at the maximum speed limit. The minimum lane speeds used were 60 mph for the left (median) lane and 45 mph for the right (shoulder) lane. At the three-lane study sites, the central lane was posted for a minimum speed of 55 mph, and at four-lane sites the minimum speeds used were 60 mph for the two left lanes and 55 mph and 45 mph for the two right lanes.

From the analysis of individual vehicle speeds several things were learned.

- (1) There was little evidence of increased average speeds due to signing. In fact, most study sites showed a decrease.
- (2) With the average speed in the range of 67 mph for the left lane of high speed rural freeways, and the variation in speeds only four to six mph, it was found that a vehicle traveling at the posted minimum speed (60 mph) would often be impeding traffic.

At all of the sites studied, approximately 95 percent of the traffic in the left lane traveled faster than 60 mph, both before and after the installation of the signs. The posted minimum speed of 60 mph would make it difficult to cite a driver for impeding normal traffic flow even when he actually is impeding traffic that is going faster than 60 mph. (This could lead to the conclusion that, to be effective, minimum speed limits should be higher than those tested, and perhaps the minimum speed limit should be even higher than the maximum speed limit!)

The most unexpected result of the minimum speed signing was a shift of traffic to the left. This shift caused the reduction in mean speeds, because it built up congestion in the high speed lanes. It also resulted in increased violation of the minimum speeds; increased passing on the right; and increased, instead of reduced, travel time.

It would appear that there may be subconscious psychological factors involved with many slow drivers who drive about 60 mph, but who do not realize, or do not admit to themselves, that they are "slow drivers." When they see signs implying that the slower traffic should keep right, they assume that faster traffic (namely themselves) should keep left.

From an operational point of view, it must be concluded that imposing minimum speeds by lane showed little or no positive advantages, and showed some definite disadvantages.

Furthermore, since the average speed on the mainline of a freeway running at capacity is approximately 35–45 mph, minimum speed signing would not be a factor in the relief of congestion which occurs when a freeway reaches capacity.

Nor would there be any advantage in safety, for if minimum lane speed signs were posted on all freeways throughout the state, it would mean the construction of many sign bridges. As determined by previous research, fixed-object accidents constitute 25 percent of all freeway accidents and have a much higher fatality rate than other accidents. The overall safety of freeways would, therefore, be decreased.

Also, additional overhead signs would not be consonant with current efforts to enhance the aesthetic quality of highways.

Finally, costs would be heavy. At a spacing of two miles, the cost of sign bridge installation would be approximately $7,000 per mile on a four-lane facility, $8,200 per mile on a six-lane facility and $10,000 per mile on an eight-lane facility. There are approximately 2,000 miles of existing freeway in California, so the expense would be somewhere between $15 and $20 million. Annual maintenance costs would be in addition.

"With evidence of operational and safety disadvantages, and little or no positive improvement, the placement of minimum speed signs by lane cannot be recommended," the report concluded.

(The above is a summary of a 1966 report entitled "The Feasibility of Minimum Speed Limits by Lane Number on Multiple Lane Highways." This project was accomplished by the California Division of Highways in cooperation with U.S. Bureau of Public Roads.)

Travel Time Study

By Peter G. Koltnow

AS FREEWAY SYSTEM GROWS TRAVEL TIMES SHRINK

It has been said that there are three stages in transportation development. In the first stage the emphasis is on a minimum facility that will somehow permit movement to take place. Roads and bridges are built where it is easiest and cheapest to construct them. Travel time and distance are secondary and human time is cheap.

In the second stage the emphasis is upon acceptable standards of transport service. People are willing to pay for more convenience. There is increased interest in raising the levels of efficiency in the movement of traffic and of comfort and amenity for the traveler. An effort is made to minimize the highway user's total transportation cost.

The third stage of transportation development would reflect the needs of an affluent urban society. In this third stage there is concern about how the highway facility improves or detracts from community values.

In the United States we are still largely in the second stage of highway transportation development, although the third stage may well be near at hand. For the last 10 years or so there has been an increasing concern with the quality of highway service as measured by the driver. Experts in this field are in disagreement about what elements of a highway trip contribute most importantly to "good service." Travel time, consistency of speed, frequency of stops, smoothness of pavement, freedom from distractions, relative safety, simplicity of route and attractiveness of surroundings are some of the many ingredients that go together to form trip quality.

To different drivers and at different times one or another of the ingredients may change in importance. If one must select a single trip element which best characterizes the quality of a commuting trip, however, there is little argument that travel time would be the one chosen. When a commuter describes his trip to work as "good" or "bad" he usually means that he was able to reach his destination more or less quickly than usual.

Even in general discussions of highway transportation we usually describe quality of traffic service in terms of travel time. We say that traffic is "strangling" or that it takes longer to travel from one end of town than it did years ago or that we can "get around better" now that freeway systems are generally available to us. Since vast sums of money are spent each year with the purpose of improving the quality of traffic service, it is important that some periodic measurement be made of this quality so that we can tell whether we are making progress and how much improvement we are getting for our money.

Travel time studies have been conducted in almost every major city in the United States. In the Los Angeles metropolitan area the Automobile Club of Southern California has made such studies since 1927. The usual procedure is to select a downtown starting point and record location and time periodically during a series of typical commuter trips. Studies usually use employees who keep track of their morning and evening commute trips for a period of a week or so. In the Los Angeles area these travel time studies have been helpful in demonstrating the progress brought about by the Los Angeles freeway system and by improvement of major arterial streets.

Measurements of travel time have been instrumental in countering the frequently vague and usually gloomy predictions of imminent traffic stagnation which continue to make popular reading in the daily press. In the Los Angeles area, for instance, it has been possible to measure a 30-percent increase in commuting speed in the years between 1957 and 1965. During the same period urban area population increased from 6 million to 8 million and motor vehicle registrations climbed from 3.3 to 4.3 million. Periodic travel time studies have helped the public and its representatives appreciate the improvements made as the result of a planned program of highway construction.

Two years ago it became apparent that the traditional method of measuring travel times was no longer suitable in an area as large and complex as the Los Angeles basin. The central business district is only one of many important centers for employment. As a matter of fact, only slightly more than 5 percent of the jobs in the Los Angeles metropolitan area are in the

downtown district. Many major freeway improvements on the fringes of the metropolitan area cannot be measured by a downtown-oriented travel time study. To expand the scope of these studies and provide a basis for future measurements of travel times throughout the metropolitan area, the auto club joined the Los Angeles Area of the Western Section of the Institute of Traffic Engineers in a massive travel time study as a local technical project. The Los Angeles Junior Chamber of Commerce also agreed to lend its aid to an enlarged study.

Early in 1965 a two-part program of travel time measurement was organized. In the first part employees working in a dozen major employment centers throughout the metropolitan area kept track of their commuting experiences for one week. In the second part of the study local traffic engineers made off-peak studies of travel time between major employment centers. The latter information was collected for use by businessmen and commercial interests who are involved with midday deliveries of supplies and equipment.

The Los Angeles Junior Chamber of Commerce helped contact many employers who agreed to distribute travel time study forms to their employees. The auto club prepared and distributed the forms and provided data processing and computing services for the reduction and analysis of the vast quantities of information collected. The data processing facilities of the California Division of Highways, through the Los Angeles Regional Transportation Study, were also made available. The Division of Highways hopes to make use of the travel time study information to test future travel time projections as a part of studies throughout the Los Angeles metropolitan area.

The peak hour study was conducted in May 1965 and involved over 30,000 workers in Los Angeles and Orange Counties. More than 7,000 usable returns were received from these workers. In addition to giving information on the distance traveled to and from work and the time involved, workers also described the amount of freeway driving they did and listed any unusual events which affected their travel. Almost one-half million miles of automobile commuting experience were logged by participants in the peak hour part of the study.

The off-peak part of the survey was conducted during July and August 1965 and represented over 5,000 miles of travel between major employment centers. Speeds and travel time were recorded separately for freeway travel and travel on surface streets.

Some of the study results are in the form of travel time "contour maps", showing the distances one can travel during the commuting hours to and from a dozen of the largest employment centers in the metropolitan area.

East Los Angeles Interchange, where Pomona, Santa Ana, Santa Monica, and Golden State Freeways cross, has total average daily traffic count of more than 350,000 vehicles.

These contour maps represent average conditions over the entire commuting period either in the morning or the evening. For each of the employment centers, a breakdown was made of the average speed and average distances traveled in 15-minute increments during the entire morning and afternoon commuting period. The so-called "peak hour" extends for a considerably longer period than one hour and in some cases was actually over two hours long.

The breakdown of the commuting period into 15-minute increments has been helpful to a number of businesses and government offices which have considered the possibility of staggering or shifting their work hours. The information contained in the report shows how much they are likely to gain or lose by changing their normal working hours.

The report pointed out differences in commuting habits and experiences among the various employment centers. The average morning speeds among all centers ranged from 23 to 31 mph and in the evening from 20 to 28 mph. Common to all employment areas, however, was support for the often noted statement that Friday afternoons are the worst time to travel. Differences were also noted in the distance typically traveled by employees in various centers. Workers to downtown Los Angeles, for instance, traveled about 50 minutes to get to and from work. In more distant communities, such as Santa Ana, the acceptable commuting distance was closer to 30 minutes. The greater travel times to some centers reflected greater distances of commuting, rather than slower travel service, however.

Survey results were also organized to give a picture of relative commuting ease in seven general areas of the Los Angeles basin. This information showed that the San Fernando Valley, which is currently the area of greatest growth in Los Angeles, enjoys the best commuting speeds.

The breakdown of information relating to use of freeways showed some interesting characteristics. Use of freeways in different areas is largely related to length of trip. Within any one area commuters who travel farthest make the most use of freeways and have higher travel speeds. Workers in the central area of Los Angeles, for example, who used freeways for most of their trip, lived twice as far from downtown as those who made no use of freeways, and their average speed was 50 percent greater. Long-distance freeway-driving commuters to the central area of Los Angeles lived nine miles farther from work than nonfreeway users on the average, but at the cost of only 9½ minutes more driving each way. In comparison with nonfreeway users the frequent users of freeways experienced almost mile-a-minute service for the extra miles they traveled.

Study participants were asked to record any accidents, radio "sigalerts" or other unusual occurrences that might have affected their trip. Anal-

ysis of the returns showed that it was difficult to assign any time value to the occurrences noted. In some cases an unusual event such as an accident or a sigalert was actually associated with a faster trip than normal. The experiences of commuters suggest that some motorist advisory broadcasts do not describe the most important traffic blockages and that such messages may "age" quickly. The report suggests that efforts be made to improve motorist advisory broadcast services.

Although the question was not included in the survey form, motorists offered many unsolicited comments on the causes of delay. The most common motorist complaint concerned inefficient traffic signal operation and the adverse effects of roadway construction, illegal parking or loading, stalled cars and occasionally, policemen issuing citations. In the San Fernando Valley there were frequent references to delays caused by trains.

San Diego Freeway, shown here at south edge of San Fernando Valley near Ventura Freeway interchange, at this point carries 130,000 vehicles daily.

The off-peak part of the study was conducted between the hours of 9 a.m. and 3 p.m. It analyzed speeds, travel times and distances along 43 different routes.

This portion of the study was valuable in pinpointing corridors of deficient travel service and in showing the relative value of freeway driving. There were substantial differences between the fastest and slowest routes. The fastest route, from downtown Los Angeles to Woodland Hills, was traveled at an average speed of 57 mph. The slowest, from Vernon to Downey, had an average speed of only 23 mph. Generally, lowest speeds were found in the travel corridor connecting the Los Angeles International Airport and the Vernon-Downey industrial complex. High speeds were always associated with trips making extensive use of freeways. Lowest speeds were found where no freeways were available to motorists.

This part of the study showed some interesting differences in directional speeds and travel times. For example, motorists traveling east from the Los Angeles International Airport to West Covina aways traveled more slowly than those driving west.

It was also found that there is a consistent amount of surface street traveled in any off-peak trip. Over three-fourths of the trips that included both freeway and surface street travel showed motorists using surface streets for five miles or less of their total trip, regardless of the length of the total trip. As more freeways are made available typical off-peak trips will include about four to five miles of surface street travel with the rest on freeways, regardless of the length of the trip. This finding conforms to a generally held theory of urban freeway spacing.

Average freeway speed in the metropolitan area during the off-peak hour was 57 mph and on surface streets 24 mph. Travel time between any two points was very consistent. Ninety percent of trip times were within two minutes of average trip times, suggesting that barring an unforeseen event that might severely affect highway capacity, a person can pretty well count on his off-peak trip taking a predictable length of time.

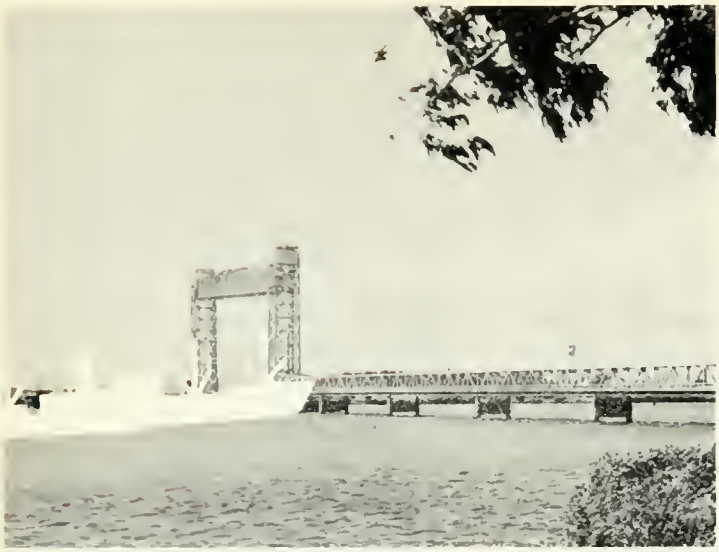
The 1965 metropolitan travel time study in the Los Angeles area clearly points out the need to proceed with the area's planned freeway system without delay. Poor travel service was uniformly associated with those corridors of travel where no freeway routes were available. The study also emphasizes the need to apply well-known traffic engineering techniques to improve the surface street system, which in the Los Angeles area handles about 70 percent of all travel. It is also apparent that there are serious conflicts between the needs of the traveling public and those whose work requires street openings or excavation.

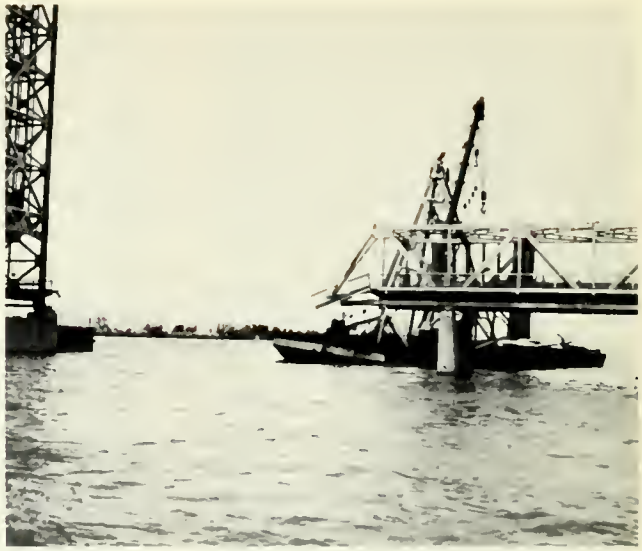
The 1965 travel time study was a pioneering effort in many respects. It examined the subject of travel time on a new, metropolitan scale. It brought together a number of groups with different skills and melded their efforts in a productive investigation of an important part of our daily lives. It was based on the combined experiences of large numbers of motorists whose help had not previously been used for studies of this kind.

Travel time studies in large metropolitan areas could well imitate the scope of the Los Angeles study. To insure that highway services in these large communities are being measured adequately, it is especially important that there be periodic repetition of these studies so that highway officials, transportation planners, legislators and the general public have a clear and accurate picture of changes in highway transportation service. While pioneering efforts such as the Los Angeles study can well be taken up by informal cooperative arrangements among interested groups, over the long haul it is important that the responsibility for these studies be considered a routine part of the urban transportation planning programs carried on by organizations such as the Transportation Association of Southern California, South Coast Transportation Study, and San Diego Metropolitan Area Transportation Study.

Busiest spot in the Los Angeles Freeway system is the Harbor-Santa Monica Freeway Interchange, used each day by 400,000 vehicles.

Copies of the *1965 Los Angeles Metropolitan Travel Time Study* are available from the secretary-treasurer, Western Section ITE, Terminal Annex Box 2890, Los Angeles 90054.

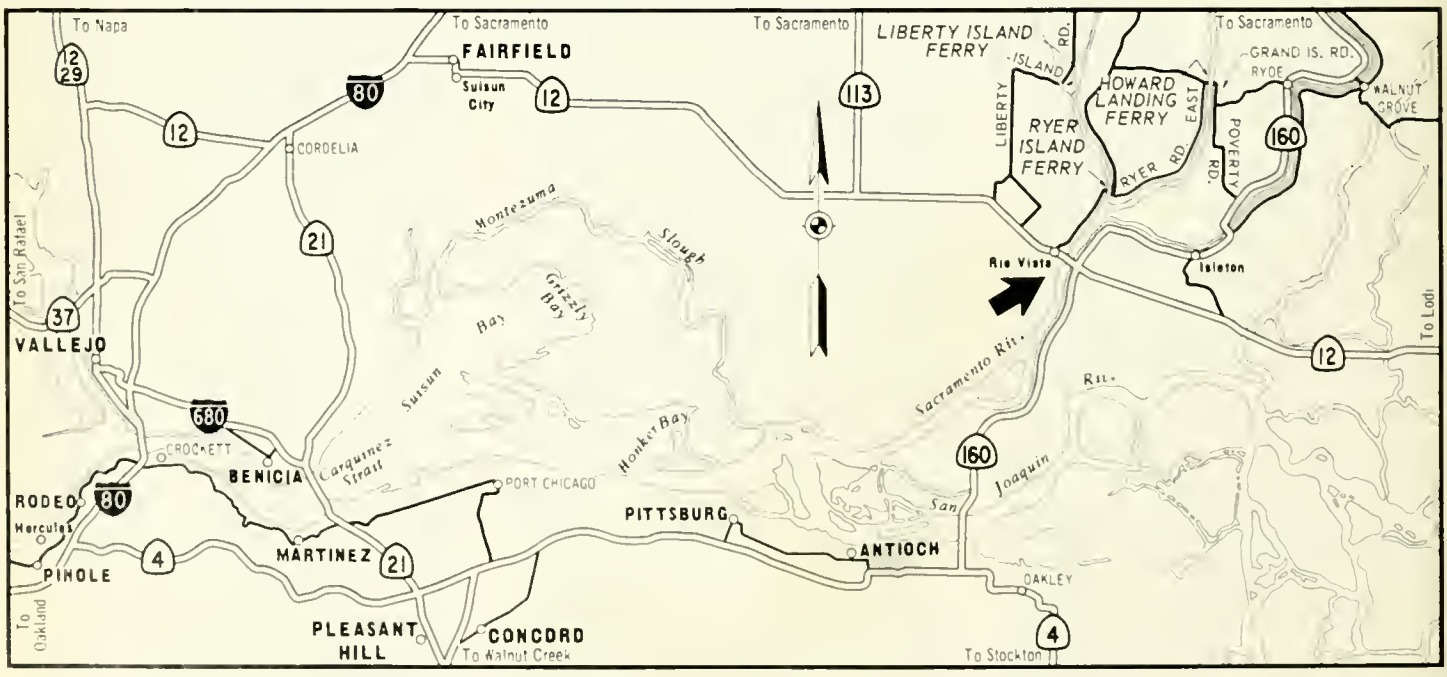




Rio Vista

MERCHANT VESSEL CARRIES AWAY ENTIRE TRUSS SPAN IN FOG

Map shows area served by Rio Vista Bridge (arrow, right center). Due to many sloughs and channels in Sacramento-San Joaquin River Delta, road connections are limited, and loss of bridge necessitated detour either via Fairfield and Benicia-Martinez Bridge or over county routes with two limited-capacity ferry crossings.



Far left: Artist's concept of how merchant vessel struck bridge in fog. Center left: Opening in crossing after missing span carried away, with barge mounted derrick removing damaged members. Left: Closeup view of damage. Although adjacent truss span remained in place, it also suffered considerably.

Bridge

In dense fog late Sunday afternoon, January 15, the Italian freighter *Ilice* missed the open draw on the Rio Vista Bridge across the Sacramento River and carried away an entire truss span. Damage is estimated at more than $500,000.

There were no injuries, although two teenage boys, Mark Ackerman and Jamie Cove, both of Stockton, had parked their car at the barrier and were standing at the open draw to see the ship go through. When the vessel struck behind them, both ended up in the river, but they were quickly rescued.

Bridge tender Clyde Spencer of Rio Vista was at his control station a hundred yards away at the time of the crash, across the open span. He could hear the commotion, but because of the poor visibility was not sure what had happened and had a few anxious moments.

Although the engines of the 10,000-ton vessel were backing at the time of impact, her momentum and weight carried away the roughly 400-ton span as though it were made of matchsticks. *Ilice* was trapped in the wreckage for about four hours until tugs could pull her free, but she suffered only minor damage and proceeded to the Port of Sacramento under her own power to take on a load of rice for Japan.

The break in the bridge interrupted the use of State Route 12 at the river, and the structure was out of service for about three weeks until a temporary span across the gap could be completed. Damage was extensive, in addition to the lost span. Concrete pier pedestals were cracked and broken, an additional 36 feet of the adjacent span must be replaced, and paving for some distance from the point of impact was disturbed. Possible damage to the structure's alignment and underwater construction had to be investigated under tedious and difficult conditions.

Emergency repairs were effected by constructing a steel pile bent and crossing the gap with two 72-foot spans of steel girders from the Division of Highways stock. The temporary structure provides for two lanes of legal loads.

In the meantime, a new truss span is being fabricated in the San Francisco Bay area. When it is completed, it will be floated upriver on the huge barge and crane combination which is intermittently used to place the girders for the new San Mateo Bridge. The crane will then remove the temporary structure, and drop the new span into place. Hopefully, the permanent repairs will be completed about June 15.

Since the bridge was handling about 5,000 cars daily at the time its service to the public was interrupted, there was considerable inconvenience to the local residents. This was complicated by the lack of a suitable bypass route. Immediate water taxi service was furnished by the proprietor of Uncle Bobby's Resort, and by a Sixth Army landing barge which carried school children.

As soon as Department of Public Works lawyers could arrange for liability insurance, a service agreement between the Division of Highways and the Sixth Army was effected, with the Sixth Army operating a landing barge on a regular schedule to handle pedestrians.

State Highway Engineer J. C. Womack praised all agencies involved in working out the prompt arrangement, saying "We were worried more about the movement of people—workers, businessmen and hospital cases—than we were about vehicles. Although an awkward situation, the transportation system in the two affected counties could continue to function during the emergency by pooling vehicles at both ends of the ferry."

Bylines

FREEWAY BEAUTY Mrs. Valley M. Knudsen (1), founder and chairman of Los Angeles Beautiful, was born in Chicago but lived most of her life in southern California.

Long prominent in civic and cultural affairs, she has been listed in *Who's Who in America* since 1947. Honors bestowed on her include the King Christian Liberty Medal and the Royal Service Medal in Gold with Crown presented by the King of Denmark for work done during World War II, the Times Woman of the Year Award in 1952, and the Distinguished Service Award of the California Council of the American Institute of Architects and U.S.O. Service Award, both in 1961. She also holds a doctor of laws degree from Loyola University of California.

Her travels during the past 35 years have taken her all over the world, including four trips to the Soviet Union and satellite countries.

1

BRIDGE STEEL WELDS Art German (2) is a native of Brooklyn, New York, who received his B.A. degree from Brooklyn College and M.A. from Stanford University. During his career as a newspaperman before joining the state in 1965, German won Associated Press spot news reporting awards for three consecutive years (1958-60) and was cited by the American Political Science Association in 1960 for distinguished reporting of municipal affairs. He is now information officer for the Division of Bay Toll Crossings.

2

3

HIGHWAY TO SPACE BASE Richard R. Crandall (3), a native of Springville, Utah, and graduate of Utah State University, is now an associate highway engineer with the Division of Highways San Luis Obispo office. He joined the division 17 years ago. For the past nine years he has been doing design work. This has included large freeway projects in District 5, which contains a large portion of the central coastal area of California.

STORM HAVOC IN DISTRICT 6 Edwin L. Tiedemann (4), administrative officer in the Division of Highways Fresno office, started work with the division in Los Angeles in 1951. Prior to his present appointment he served as an engineer in design and as an administrative assistant in the Sacramento headquarters construction department. Tiedemann was born in Silver Creek, New York, and attended the University of Illinois.

4

MINIMUM SPEED LIMITS Norman Wingerd (5), associate highway engineer, was born near Abilene, Kansas, and graduated from Los Angeles State College. He joined the Division of Highways Los Angeles office in 1956. Prior to his transfer to Sacramento in 1966 to do traffic flow research, he was resident engineer on a section of the Pomona Freeway through Monterey Park.

5

TRAVEL TIME STUDY Peter G. Koltnow (6) is traffic engineer for the Automobile Club of Southern California. He was study director of the 1965 Metropolitan Travel Time Study for the Western Section of the Institute of Traffic Engineers and has also directed similar previous studies for the auto club. Before coming to work for the auto club Koltnow served as traffic engineer of Fresno County for six years.

6

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